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TROPICAL BUILDING DESIGN AND CONSTRUCTION

THE design and construction of buildings in the tropics raises many problems in view of the variety of climates that obtains in the region and the conditions of living which are economically backward. These were considered by a large group of experts at a symposium* held in Delhi, with a view to assess the part which science can play in their solution.

Discussing the general principles of building design in the tropics, it was pointed out that each climatic sector called for individual interpretation and treatment by the designer. These sectors are marked off from one another by variations in climatic factors such as direction and intensity of wind, temperature range and relative humidity, distribution of rainfall and duration and intensity of solar radiation. But it would appear that in many constructions in this region, these climatic factors have not been suitably taken into account. The symposium, therefore, recommended that a wider use be

made of tabular climatic data and charts as are already available in each iso-climatic sector and that steps should be taken to supply the deficiency in the other sectors also.

The physical features of the site, such as slope, tree cover, etc., play an important part in the layout of a building. Thus, advantage can be taken of natural slopes to provide for easy drainage and sewage disposal. It was pointed out similarly that dwelling consisted not only of the space within the plinth area, but included also part of its immediate surroundings. Thus, trees appropriately sited near the house, provided outdoor living space below them, for the family and for guests; also such trees could afford, if suitably situated, protection against direct sun rays, wind and rain to the inmates, and protection also to the building itself. The symposium in this connection also recommended that there should be provision of space for vocational work and shelter for domestic animals, and that a survey should be made of traditional building methods and local forms of house design and construction in the

* Report of the Regional Symposium held on the subject in Delhi during December 1952.

different parts of the region, showing in particular, their relationship to climate and indigenous materials.

In regard to building materials it was felt that until the availability of cement increases, concrete would find its application mainly in cities where there was a paucity of other suitable building materials, and also for large public constructions in areas within easy reach of cement factories or a sea port. Several papers in the symposium were directed to a discussion of the properties and uses of light-weight concretes, using locally available aggregates; special attention being given to vermiculite, since sizable deposits of it were available in Mysore and West Bengal. Other important light-weight aggregates referred to, were volcanic ashes, obsidian, rice husks, wood wool, bagasse and other vegetable fibres. There seemed, however, to have been little scientific research on the use and development of these light-weight concrete materials. Reference was also made to aerated concrete and particularly, to the use of *ritha* (the fruit of a tree resembling the tamarind and containing 25 per cent. saponin) as a foaming agent; however, there did not seem to be any long-range experience in the use of this reagent.

In this connection, the following are some of the recommendations of the symposium: (1) further research into the long-term behaviour of light-weight concretes, especially those made from organic aggregate materials, should be undertaken; (2) facilities for the study of better brick-making processes should be provided; (3) improved uses in building of earth, particularly in a stabilised form, should receive wider publicity, since this material has good potentialities in many areas, and that building material testing laboratories, distributed throughout the area, be made responsible for the testing and control of improved earth building; (4) the use of laminate and treated timber should be encouraged immediately; and (5) composite bamboo-concrete construction is to be investigated thoroughly by a recognised authority.

With reference to construction practice and vocational training, it was felt that University

courses in Engineering and Architecture may advantageously include adequate training in the technique of job organization and labour management at site level. Also, adequate vocational training schemes should be provided for workers in the building industry, and provision made to keep them abreast of the latest developments in their particular fields. Especially, long-term building programmes should be designed wherever possible, so as to ensure that workers may become proficient at their job and also with a view to reduce fluctuations in the use of plants and labour man-power.

A number of papers were presented at the section relating to provisions for comfort, sanitation and public health. As a result of the discussion, the symposium recommended that investigations be made in different climates of the region to determine the thermal insulating behaviour of different wall and roofing constructions so as to provide more comfortable conditions indoors during extreme changes of weather. It was also suggested that a special symposium should be organised to deal with the problems of sanitation, water-supply and other health aspects of housing.

A special section was devoted to a consideration of the organisation of research, testing procedures, the maximisation of the results of research through standardization and the use of building information services. A very useful report by ILO surveyed building research and experimentation already carried out in the Asian region. At length, the symposium resolved that national bodies, similar to the Indian Standards Institution, be set up elsewhere in the region and that consideration be given to the possibilities of Shape Engineering in effecting substantial economies in both steel and reinforced concrete structures, with due regard to factors of corrosion, fire resistance, manufacturing limitations and structural stability. Having noted with satisfaction the establishment of the INSDOC, it was suggested that in order to ensure adequate provision, exchange and dissemination of scientific and technical knowledge on all aspects of building design and construction, steps may be taken to set up a more specialised Building Information Service at an early date.

KALINGA AWARD FOR 1953

THE Kalinga Award for distinguished popular writing in science was made this year to Dr. Julian Huxley, at a ceremony in Paris on July 2. Dr. Huxley, who was UNESCO's first Director-General, had been nominated for the

prize by both the Royal Society of Great Britain and the Institute de France. The first award, in 1952, went to the French scientist, Prince Louis de Broglie.

DIASTROPHISM AND EVOLUTION

L. RAMA RAO

SO far back as 1909, Prof. Chamberlin put forward the view that 'diastrophism is the ultimate basis for dividing geologic history' and maintained that 'in these deformative movements, there seems to be a universal, simultaneous, and fundamental basis for the subdivision of the earth's history'. During all these years, this question in some form or other has been the subject of much discussion and controversy among geologists and palaeontologists all over the world. With a view to critically examine and take stock, as it were, of the present position in this fascinating field of study, a comprehensive symposium was recently organized in America under the striking,—nay, sensational,—title "Distribution of Evolutionary Explosions in Geological Time", an account of which has been published in the *Journal of Palaeontology*.^{*} The various papers contributed to this symposium by distinguished workers in the different fields of research serve to indicate the many lines of possible approach to the study of this problem, and reveal the complicated interrelationships involved in their mutual correlation. The main problem is to discuss how far Prof. Chamberlin's concept is acceptable to-day in the light of the known facts of palaeontology and evolution, in relation to diastrophism.

As pointed out by Dr. Lloyd G. Henbest in his opening address to the symposium, the logic of Prof. Chamberlin's dictum rests on certain postulates as follows: (i) that diastrophism is periodic and synchronous on a worldwide scale, and (ii) that diastrophism is a major control, if not the principal stimulus, of organic evolution; and therefore (iii) that organic evolution and crustal movements conform to the same worldwide rhythmic pattern. On the basis of recent studies, geologists, biologists and palaeontologists will readily realise that on both the premises (i) and (ii) there is considerable and sharp difference of opinion to-day, and that therefore the conclusion (iii) rests on very uncertain foundations. After pointing out the several ways of constructing and calibrating a geologic time-scale, and discussing their relative dependability, Dr. Henbest shows that anything like a worldwide break or a worldwide unconformity is an inconceivable proposition from the known facts of geological processes of erosion and sedimentation, and that the idea of a 'pulse' or 'rhythm' in denoting the periodicity

of geological and biological changes in time, is being overdone.

From the palaeontological side, which is perhaps the most important in this study, Dr. Arthur Cooper and Prof. Alwyn Williams, in their paper, have examined the evidence and significance of the stratigraphic distribution of Brachiopods in the consideration of this problem. Their survey shows that while it is true that there seem to be certain evolutionary 'bursts' in the history of the Brachiopods, these 'are distributed in time serially, and without very clear relation to the geologic periods' and that 'they show considerable provinciality'. In another paper, Prof. Raymond C. Moore looks at the problem from the point of view of the evolution rates among Crinoids,—a group which he says is specially suited for the study of evolutionary trends and rates 'because of the complexity of their skeletal organization, remarkable range of adaptive variations, long geologic history, and abundance of described species'. After analysing the evidences furnished by the different species of this group, and presenting them in the form of nice graphs, Prof. Moore points out that this survey 'calls attention to stratigraphic and regional concentrations which seem to signify an acceleration of specific differentiation that is more or less localized in time and space' and reveals that there is a 'noteworthy tendency for maximum proliferation of species in middle divisions of geologic systems'. In two succeeding papers, this problem of periodicity in evolution has been fully discussed,—Dr. Norman D. Newell looking at it from the point of view of Invertebrates, and Dr. George Simpson, of Vertebrates. These two papers may generally be considered to support the view that 'the fluctuations in evolutionary activity are not directly related to times of widespread orogeny, and that there is no indication that peak times of evolutionary activity correspond with times of extensive orogeny'. After the reading of these papers, there was a lively discussion; and the consensus of opinion at the end of the symposium was that while it was true that environmental changes have an influence on evolution, they constitute only one of the many factors affecting the trend and pace of evolutionary changes, and that therefore any intimate and exclusive relationship between Diastrophism and Evolution as was implied in Prof. Chamberlin's dictum is altogether unacceptable to-day.

* *Journal of Palaeontology*, May 1952, 26, No. 3.

It must, however, be realised that the subject-matter of this symposium deals with certain fundamental issues which constantly come up for consideration in dealing with several geological problems, especially in the field of biostratigraphy and geochronology. Here in India, for instance, we have quite a number of problems of stratigraphical classification and correlation in the discussion of which questions relating to the origin and evolution of life forms have to be considered on the lines embodied in the symposium. One of the most important of such studies is that dealing with 'Boundary Problems'; and the present writer's papers on the 'Cretaceous-Eocene boundary' in India will serve as an example to illustrate this point.

Then again, we have the problem of what look like "discrepancies between the chronological testimony of fossil plants and animals", and these require clarification. Indian stratigraphy offers many such problems; and these were discussed some years ago at the Silver Jubilee Session of the Science Congress (1938) held at Calcutta and dealt with much the same aspects of diastrophism and evolution embodied in the present symposium. It is interesting to note, in the present context, the following observation made by one of the speakers at the Calcutta discussion: 'The syntheses of the so-called geological philosophers, with their cycles and epicycles of diastrophism and their rhythmic orogenies are foredoomed when extended beyond provincial developments in an attempted worldwide application'.

It is in the study of the evolutionary history of fossil plants that we come across some of the most striking examples of certain periods when there seem to be sudden and abrupt changes in the manner and rate of evolution resulting in a complete 'transformation' in the character of the floras; and there has always been a temptation to correlate such periods with corresponding periods of diastrophism, and establish a relationship of cause and effect.

Prof. Seward in his famous Hooker lecture (1922) referred to this aspect and discussed the deep significance of such 'nodal points' in the history of plant evolution. A couple of years later, Dr. D. H. Scott drew our attention to the four periods of 'transformations' in the evolutionary history of plants and re-discussed the whole problem in the light of Prof. Seward's views. More recently (1937), Prof. Birbal Sahni reverted to this topic again in his address on 'Revolutions in the Plant World' and reviewed the whole position from various points of view, making some very interesting comments and suggestions. He concluded by saying that while the problem of these 'revolutions' still defies solution, one broad fact remains, viz., 'that some of the periods of the most active creation of new forms of life have coincided with the physical revolutions of the geological past'. Dr. and Mrs. Jacob, in their recent article in *Current Science* (1953) have also referred to some aspects of this study, and tried to show a relationship between cyclic geological phenomena and their influence on plant evolution through the ages.

From this general review, it is clear that the question of establishing any kind of intimate relationship between Diastrophism and Evolution—and that, on a worldwide basis—is not so simple as it looks; and the great difficulty is to account for the selective manner in which this relationship has operated at different times and on different groups. The facts of the case are by no means clear or conclusive. 'Evolution' implying the progressive appearance and disappearance of life forms, has obviously been a very complicated process resulting from the action, reaction and interaction, of a variety of factors; and while it is true that the palaeontological record reveals certain periods of abrupt and rapid changes, it would appear that in both the geological and biological fields, such revolutions are merely 'provincial interruptions in an evolutionary continuum'.

ELECTRONMICROSCOPY FOR STUDY OF THE NERVE SYSTEM

IN studying the conducting threads of nerves under a light microscope, the finer fibres are seen to have a jelly-like inner part and a pearly sheath of fatty substance, called myelin, enclosed in thin membrane. This membrane and the fine fissures found in it are all that it has been possible hitherto to discern. By using different reagents it was only just possible to see the outer structure through the light microscope, the earliest signs of which are extremely thin

fibriles, the so-called neuro-fibriles, in the inner part of the nerve thread.

However, using the electron microscope, Prof. H. Fernandez-Moran, of the Karolinska Institute, has observed the fine structure of the inside of the thread and has shown that the myelin sheath consists of over 100 layers, each only about 80-100 Å thick. These layers are as thin as those discovered by F. Sjöstrand in his pioneer examination of the structure of the eye's retina, and later in the peripheral nerve.

ON THE EXCHANGE MECHANISM IN BONE

T. K. WADHWANI

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BASED on their phosphate exchange reactions *in vivo*,¹⁻⁵ the calcified tissues have been regarded⁵ as composed, physiologically at least, of two parts; the one, that rapidly comes to equilibrium with the blood minerals, and changes its composition in conformity with the mineral composition of the blood, has been designated as labile, and the other, which is relatively much less affected by the composition of the blood, has been designated as stable or non-labile. Though no experimental proof so far has been produced to support this theoretical division of the calcified tissues into labile and non-labile parts, the exchange reactions, which the calcified tissues, more particularly the bones, enter with the mineral constituents of the blood, have, nevertheless, been sought to be explained on the basis of this hypothesis. Recently, it has been shown^{6,7} that bone salt also exhibits similar exchange reactions *in vitro*. When bone salt is equilibrated with a solution of NaF, it is observed that fluoride is removed by the bone salt, and that the corresponding quantity of the anions like CO_3^{2-} and PO_4^{3-} is released from the bone salt into the liquid phase in the manner of Freundlich adsorption isotherm. It was thought that the anions of the bone salt that are thus exchanged with the fluoride of the liquid phase, which gets adsorbed, are probably likewise already adsorbed on the bone salt, and constitute what has been termed as its labile part, and that by repeatedly equilibrating a given quantity of bone salt with a solution of NaF, and determining the quantity of the fluoride adsorbed, and the quantities of the anions of the bone salt liberated into the liquid phase, it should be possible to determine the relative quantities of labile and non-labile fractions in a given quantity of bone salt, and thus experimentally substantiate the above hypothesis. Based on these observations and arguments, an attempt has been made to determine the amounts of labile and non-labile parts of bone salt. A sample of bone salt (percentage composition: N = 4.97, Ca = 26.42, P = 12.72, Mg = 0.47, Na = 0.36, F = 0.073, CO_3 = 4.25, Residual Ca = 23.59, Ratio Residual Ca : P = 1.85), weighing 1.002 g., was equilibrated with a solution (2.5 per cent.) of NaF. At equilibrium, the quantity of fluoride adsorbed, and the corresponding quantities of CO_3^{2-} and PO_4^{3-} , released from the solid phase into the liquid phase,

were determined. As the replacement of adsorbed anions of bone salt, and their consequent release into the liquid phase, when a sample of bone salt is equilibrated with a solution of NaF, is determined by the concentration of fluoride in the liquid phase, and as the concentration of NaF in the liquid phase cannot be raised beyond 4 per cent., that being approximately the solubility of NaF in water, and as the quantity of adsorbed anions released into the liquid phase with a 4 per cent. solution of NaF may either be the total quantity of adsorbed anions in a given quantity of bone salt or a part thereof, the same bone sample, after its quantitative separation from the liquid phase, was again equilibrated with a fresh aliquot of NaF solution. This process of repeated equilibration was continued till the liquid phase at equilibrium was not found to contain phosphate or carbonate. The process of equilibration of the above quantity of the bone salt with a solution of NaF was carried out 12 times. In the twelfth equilibration study, it was observed that the liquid phase at equilibrium contained no carbonate, about 0.3 mg. of P (per 50 c.c. of the solution), and had the fluoride concentration little higher than that of the original solution, indicating that the capacity of the above quantity of the bone salt to enter into exchange reactions had been reached, and that the further quantity of fluoride was not only not being adsorbed but that part of the previously adsorbed fluoride was being released back into the liquid phase. At this stage, the bone salt was quantitatively collected and analysed, and was found to contain a trace of carbonate, 10.12 mg. of P, and 233.7 mg. of F, as against the initial values of 43.43 mg. of CO_3 , 130.0 mg. of P, and 0.7459 mg. of F. Thus, it can be seen that about 94 per cent. of the anions in the above quantity of bone salt, by the process of repeated equilibration with a solution of NaF, has been replaced by fluoride in the manner of Freundlich adsorption isotherm, and that it has not been found possible to replace likewise the remaining percentage of anions with fluoride. Can it now be assumed that the remaining percentage of anions represents that part of the bone salt, which has been termed non-labile and real, and that the considerably large percentage of anions, that have been replaced with fluoride, represents that part of the bone salt, which has been designated as

labile or adsorbed? Before answering this question, it is desirable to consider the theoretical possibility of the replacement with fluoride of the remaining percentage of anions in the bone salt. There does not seem to be any reason as to why it cannot be assumed that it is possible to replace, in the manner of Freundlich adsorption isotherm, the remaining percentage of anions in the bone salt with fluoride, provided, fluoride, under such conditions, is adsorbed by the bone salt. It can be seen from the data presented that, in the twelfth equilibration study, the liquid phase contained no carbonate, about 0.3 mg. of P per 50 c.c. of the solution, and had the fluoride concentration little higher than that of the original solution, indicating that further quantity of fluoride was not only not being adsorbed but that part of the previously adsorbed fluoride was being released back into the liquid phase. As fluoride was not being adsorbed, the remaining anions were not being replaced with it, and consequently were not being released into the liquid phase. Such a circumstance, however, can be viewed differently also. Further quantities of fluoride were not being adsorbed by the bone salt, because there were no replaceable anions left in it. In that case, the remaining percentage of anions will have to be regarded as that fraction of the bone salt, which has been designated as non-labile and real, and the rest of

bone salt, as labile and adsorbed. However, it does not seem to stand to reason to assume that so large a fraction as 92 per cent. of the total P in the bone salt is adsorbed on the remaining 8 per cent. Under such circumstances, the only other alternative has to be accepted that all the anions in the bone salt, at least theoretically, can be replaced with fluoride by the process of repeated equilibration, and in the manner of Freundlich adsorption isotherm. Thus, the theoretical division of bone salt, into labile and non-labile parts, has not been found to be correct *in vitro*. It seems to be the fundamental property of the bone salt to enter into exchange reactions with the anions of the liquid phase in the manner that can approximately be denoted by the Freundlich adsorption isotherm. Such a property of the bone salt may be the basis of the exchange mechanism in bone *in vivo*.

The author wishes to thank Prof. K. V. Giri for his keen interest in the work.

1. Chiewitz and Hevesy, *Nature*, 1935, **136**, 754.
2. Hahn and associates, *Biochem. J.*, 1937, **31**, 1705.
3. Manly and Bale, *J. Biol. Chem.*, 1939, **129**, 125.
4. Hevesy and Armstrong, *Ibid.*, 1940, **133**, p. xlv.
5. Manly and associates, *Ibid.*, 1940, **134**, 293. 6. Wadhvani, T. K., *Curr. Sci.*, 1951, **20**, 293. 7. —, *Communicated to the Ind. Chem. Soc.*

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

THE European Organization for Nuclear Research has emerged from its planning phase and will shortly become a reality under the terms of a Convention signed recently in Paris by representatives of twelve nations.

The programme for the new European Organization includes the construction of a new international laboratory for nuclear research, and the continuation of co-operation between existing laboratories in the various countries.

The construction of the laboratory and its equipment is expected to require seven years. The cost of all activities during those seven years will total 120 million Swiss francs, including construction of the laboratory and its equipment. This will consist mainly of two large

accelerators, a synchro-cyclotron, which will probably be completed in four years, and a proton synchrotron that will take seven years to construct.

When the Convention becomes effective, it is planned to build the laboratory near the French border three miles north-west of Geneva.

The research will be fundamentally scientific and of non-military character. None of the work will be secret. The laboratory will not include an atomic reactor and will not be used for the production of high-energy materials. It will be used only to study the properties of atomic nuclei, and of such elementary particles as protons, neutrons and mesons.

RADIO ENGINEERING*

HARDLY any book on the fundamentals of radio met with such diverging criticism as the "Sandeman", when it first appeared in 1949. Completely enthusiastic reviews on the one side and condemnation of many aspects of the book on the other side† seem to indicate the need for an individual approach and a subjective evaluation of the merits of the book. The fact that a second edition is to follow the first within a short period of four years gives the best answer to the controversy in the learned journals. Many readers apparently found very valuable information in the book, for which they might have searched in vain at other places. Indeed the book is an unconventional one in many aspects. Written by one thoroughly familiar with the technical problems of one of the world's biggest broadcasting systems (B.B.C.) we may expect to find a lot of reference to the specific techniques and practices obtaining in such laboratories and also details about their installation. Transmitters naturally will get preference to receivers. Practical hints are widely spread over the two volumes and emphasis is given to methods of measurement needed preferably in radio broadcasting systems. Many reviewers deprecated this undoubted bias of the book, others stressed the importance of publishing such material in book form.

In the second volume the author tries to balance this bias for the practical aspect by including 140 pages on network theory and filters. We feel that previous reviews did not do full justice to the excellent presentation of the so-called German method of network analysis and synthesis. The full-scale reproduction of matrix-tables for four-poles from the German journal "Elektrische Nachrichtentechnik" will help English readers to familiarise themselves with this important tool of network theory. The chapter on filters constitutes a welcome deviation from conventional text-books by stressing the practical side of filter design. It is regretted, however, that the second edition does not refer to the component design and to the actual layout of commercial filters. Considering the above-

mentioned bias of the book, one ought to expect in it such important aspects as the design of maximum Q coils, the selection of best suited capacitors for filters or the influence of magnetic stray-coupling on the characteristics of medium frequency filters. Instead, we find in the new edition a 30-page chapter on transmission line filters with many design charts which will be welcomed by the readers.

Some of the other chapters have been improved for the new edition, but not largely changed. They relate to balanced and unbalanced circuits, interference and noise, measuring equipment, equalizer design, audio expansion and compression and finally feed-back. The 50-page chapter on receivers has generally been considered too short, compared with the rest of the book and suggestions had been made by previous reviewers, to omit it as a whole and call the book "Broadcasting" or "Transmitting" technique. The author, however, has kept the chapter untouched for the second edition. Even apparent mistakes as the one on pages 87 to 89 (where Fig. 1 refers to a delayed a.v.c. circuit having a delay voltage across R_1 , whereas the text describes the circuit as one of undelayed character, stating at the top of page 89 that "delay voltage has to be inserted in series with the diode in Fig. 1") have not been corrected. Likewise, the bibliography at the end of the book is very incomplete and misleading. There is not a single reference to articles after 1949 and only a few references to those since 1940, so that the bibliography is now much out-of-date for a second edition.

R. FILIPOWSKY.

* *Radio Engineering*, Vol. 2. By E. K. Sandeman, 2nd Revised Edition, 1953. £13 pp. 55 sh. Chapman & Hall, Ltd., London.

† Compare some of the reviews to the first edition: *Wireless Engineer*, December 1949, **26**, 412-13; *Electronic Engineering*, June 1950, **22**, 252-53; *Journal of Sci. Instruments*, April 1950, **27**, p. 112; *J. Franklin, Inst.*, 1949, p. 207; *Toute la Radio* (Paris), Oct. 1949 (No. 139), p. 272.

NON-FERROUS METAL INDUSTRY IN INDIA

A SYMPOSIUM on Non-Ferrous Metal Industry in India is to be held at the National Metallurgical Laboratory, Jamshedpur, in January 1954. Topics to be discussed will include extraction and refining of non-ferrous metals, melting and foundry techniques, and economics of Indian non-ferrous metal industry. Those

wishing to present papers may please forward an advance copy of their papers to the organisers before 15th November 1953, so that the final programme, abstracts of the papers, etc., may be drawn up and circulated. Equipment for the projection of slides and drawings will be available.

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ACHROMATIC CONDITION FOR
A COMBINATION OF TWO LENSES
KEPT AT A DISTANCE

THE treatment here follows that of Moffitt¹ for two lenses in contact.

The focal length of a combination of two lenses separated by a distance d is given by

$$1/F = A(\mu - 1) + A'(\mu' - 1) + AA'd(u - 1) \quad (1)$$

where μ and μ' are the refractive indices of the materials of the two lenses.

$A = \{(1/r_1) - (1/r_2)\}$ and $A' = \{(1/r_1') - (1/r_2')\}$, r_1, r_2, r_1' and r_2' being the radii of curvature of the surfaces of the two lenses.

Putting $dF/d\lambda = 0$ we get the following condition for complete achromatism

$$A(d\mu/d\lambda) + A'(d\mu'/d\lambda) + AA'd\{(\mu - 1)(d\mu'/d\lambda) + (\mu' - 1)(d\mu/d\lambda)\} = 0 \quad (2)$$

Using the simple Hartmann dispersion formula, which holds empirically in the visible region of the spectrum,

$$\mu = \mu_0 + c/(\lambda - \lambda_0)^a \quad \text{and} \quad \mu' = \mu'_0 + c'/(\lambda - \lambda'_0)^{a'} \quad (3)$$

and substituting (3) in (2) we get

$$C_1(\lambda - \lambda_0)^{a+1} + C_2(\lambda - \lambda_0)^{a'+1} + C_3\{a'(\lambda - \lambda_0) + a(\lambda - \lambda'_0)\} = 0 \quad (4)$$

where

$$C_1 = Aca\{1 + A'd(\mu'_0 - 1)\} \quad (5A)$$

$$C_2 = A'c'a\{1 + Ad(\mu_0 - 1)\} \quad (5B)$$

$$C_3 = AA'cc'd \quad (5C)$$

(i) If a and a' are non-integral, one can write $(\lambda - \lambda_0)^{a+1}$ and $(\lambda - \lambda'_0)^{a'+1}$ as a power series in λ or $1/\lambda$. Equating the coefficients of like powers of λ or $1/\lambda$, one first gets $C_1 + C_2 = 0$, $\lambda_0 = \lambda'_0$ and $a = a'$, making the first two terms in (4) cancel each other. Thus

$C_3 = 0$ and $d = 0$, so that the only possible solution is that of two lenses in contact.

(ii) If $a = 1$ and a' is non-integral, we get complete achromatism only when $C_1 = 0$ and $C_2 = 0$. This gives infinite focal lengths for the lenses and is of no use.

(iii) If $a = a' = 1$, as is the case for most of the optical materials, then, equating to zero the coefficients of λ^2 and λ and the constant term in (4), we get

$$C_1 + C_2 = 0 \quad (7A)$$

$$C_3 - \lambda_0' C_1 - \lambda_0 C_2 = 0 \quad (7B)$$

$$C_1 \lambda_0'^2 + C_2 \lambda_0^2 - C_3 (\lambda_0 + \lambda_0') = 0 \quad (7C)$$

(7C) can be derived from (7A) and (7B). Hence we need consider only (7A) and (7B), which give

$$(1/d) = A[\mu_0 + \{c/(\lambda_0' - \lambda_0)\} - 1] \\ = A'[\mu_0' + \{c'/(\lambda_0 - \lambda_0')\} - 1] \quad (8)$$

For a particular value of either A , A' or d , the condition can be realized by a suitable choice of the optical material of the two lenses. (8) can also be expressed as

$$d = f(\lambda_0') = f'(\lambda_0) \quad (9)$$

where $f(\lambda_0')$ and $f'(\lambda_0)$ are the focal lengths of the two lenses for the wave-lengths λ_0' and λ_0 respectively.

The constant focal length of the perfectly achromatic combination is given by

$$1/F = A(\mu_0 - 1) + A'(\mu_0' - 1) + AA'd(\mu_0 - 1)(\mu_0' - 1) \quad (10)$$

the other terms vanishing under condition (7) from which (8) and (9) have been derived.

The authors acknowledge grateful thanks to Dr. K. Majumdar, Dr. G. B. Deodhar, Dr. D. Sharma, Prof. B. K. Agrawal and Dr. Y. P. Varshni for their interest in the investigation.

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REUTILIZATION OF MAC CONKEY'S BROTH FOR *B. COLI* PRESUMPTIVE TEST

It is found that MacConkey's bile salt-neutral red lactose broth,¹ giving negative results for *B. coli* presumptive test, on incubation for 48 hours at 37° C. after inoculation with treated water sample, can be reused for the same test on the basis of the following procedure.

(a) Test-bottles showing total absence of lactose fermenters, are first sterilized by steaming

for 10-15 minutes as it is found that though the medium shows negative results, still non-lactose fermenters are sometimes present in the medium. It is also found that pH of this used medium remains practically same even after inoculation and incubation. (b) Each test-bottle containing 50 ml. of the broth (triple strength) is inoculated with 100 ml. of the water sample. Thus when all the test-bottles (showing negative results) are pooled together, the bulk forms the single strength medium. (c) This medium can directly be used for filling 1 ml. test-tubes (after adjusting the pH externally to 7.6 if reduced). In order to restore the triple strength to this medium, all the usual ingredients¹ (except water and neutral red) are now added in double strength. (d) The medium is autoclaved at this stage at 10 lb. pressure for 10-15 minutes. (e) It is then filtered, pH adjusted externally to 7.6, using bromothymol blue as external indicator. Then for every 100 ml. of this medium 2.0-2.5 ml. of 1 per cent. Neutral red solution is added. (f) The medium is filled up in test-tubes and bottles and sterilized by steaming for 10-15 minutes and used.

The results obtained with the renewed medium compared very well with those of MacConkey's original broth, in case of some 200 samples, and the comparison shows satisfactory results as shown in Table I.

TABLE I

Number of samples showing
Lactose Fermenters @ 37° C.
after 48 hours (positive
in minimum quantity)

	0.01 ml.	0.1 ml.	1 ml.	10 ml.	0 in 10 ml.	100 ml.	0 in 100 ml.
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I. No. of samples tested by Renewed medium as shown above

68 Raw waters	3	30	16
51 Settled waters	..	6	31	15	..	..	..
32 Filtered waters	..	1	4	24	3	..	..
49 Chlorinated waters	..	..	..	1	..	3	45

II. No. of samples tested by MacConkey's original broth

68 Raw waters	3	41	14	..	..	..	..
51 Settled waters	..	6	31	15	..	..	..
32 Filtered waters	..	..	5	24	3	..	..
49 Chlorinated waters	..	..	..	1	..	3	45

Further, to maintain the nitrogen value at any particular level with reference to the growth

of lactose fermenters, nitrogen was determined before and after inoculation and at various stages of lactose-fermentation in the original as well as renovated broth.

It was found that approximately 50 per cent. of the nitrogen is utilised in full lactose-fermentation (for acid and gas) and 50 per cent. still remains intact in the medium. Also approximately 6 to 8 per cent. nitrogen loss occurs in the medium which gives negative results (i.e., showing absence of lactose-fermenters); perhaps non-lactose-fermenters utilise this little amount of nitrogen. However, there still remains enough nitrogen balance to permit growth of lactose-fermenters.

This renewed medium has proved to be as specific for the growth of *B. coli* group of organisms as the original medium. All the six members of the *B. coli* type of organisms have been isolated from the renewed medium showing presence of lactose fermenters. Also the traces of available free chlorine introduced in the medium along with the water sample have no inhibitory effect as is clear from the results given in the Table I.

It is suggested, however, that this renovation may be limited to 2-3 times successively. After that fresh MacConkey's broth may be used, reutilized for 2-3 times and thrown off.

Public Health Laboratory, D. T. HARIKISHIN.
Govt. of Bombay, Poona-1,
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INFLUENCE OF ENVIRONMENTAL TEMPERATURE ON THE DIETARY PRODUCTION OF FATTY LIVERS

Of the various factors involved in the dietary production of fatty livers, the role of the environmental temperature is probably the least studied. It was noticed by us that the extent of fatty infiltration of the liver (as evidenced by measurement of liver fat content) produced in animals at different times of the year varied considerably, though in all cases, the same basal dietary regimen was employed. At first these results were inexplicable, but a closer study showed that under the same dietary conditions, the fatty infiltration produced in animals during summer was higher than that produced in winter.

In experiments conducted during November and December on the production of fatty livers in rats by dietary means on a 10 per cent. casein

30 per cent. lard diet, an average liver fat value of 0.52 g. per 100 g. body weight was obtained. On the same basal diet, in experiments conducted during the months of March, April and May, the hottest time of the year, a mean liver fat value of 1.04 g. per 100 g. body weight was obtained. Similarly on a 5 per cent. casein 40 per cent. lard diet, the values for liver fat obtained were 1.13 g. in February and 1.50 g. in April. The differences between the mean temperatures in May and December in Bombay do not ordinarily exceed 10° F., but there seems to be higher variation between the maximum and minimum temperatures in December (about 23° F.) than in May (about 13° F.).

These findings are in accordance with the results of Sellers and You,¹ who have found a very much lower level of fat (7.2 ± 1.24 per cent.) in the livers of rats fed *ad libitum* on a diet deficient in choline and its precursors when the rats were kept at a temperature of 2.5° C. than (24.8 ± 4.9 per cent.) when kept at room temperature of $25 \pm 2^\circ$ C. The same authors reported in a recent paper² that when a hypolipotropic diet of moderate fat content (20 per cent.) is fed to rats exposed to a temperature of $1.5 \pm 1^\circ$ C., excessive deposition of fat in the liver is prevented. The comparative inefficiency of fat in the production of fatty livers at lower temperatures may be due to (1) greater utilization of fat at low temperatures, to satisfy the calorie requirements so that less of the fat is available for fatty infiltration or (2) higher requirements for many of the B vitamins, especially choline^{3,4,5} at higher temperatures, thus putting a greater demand for choline on hypolipotropic diets and bringing about a more acute deficiency of the vitamin. It is to be mentioned, however, that there was a difference in temperature of 20° C. in the experiments of Sellers and You, but they get a percentage liver fat difference of more than 15 per cent.; whereas in our experiments for a difference of temperature of, say 6° C. approximately, the differences in liver fat percentages do not exceed 4.7 per cent. on a 10 per cent. casein diet and 2.5 per cent. on a 5 per cent. casein diet. The detailed account will be published elsewhere.

Haffkine Institute, K. K. GOVINDAN.
Bombay, M. V. RADHAKRISHNA RAO.
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AMINO ACIDS IN SEWAGE AND
ACTIVATED SLUDGE

VERY little is known of the amino acid composition and the nature of other compounds present in sewage and sludges.¹⁻⁴ Employing the recently developed method of circular paper chromatography,⁵⁻⁷ we have made some observations on the amino acids in raw sewage and activated sludge.

Representative samples of raw sewage, activated sludge and the purified effluent were collected over a period of 5 weeks, and the dried materials (dried at 60°C.) were employed for the studies. The nitrogen contents of the materials were (% N): raw sewage, 3.82; activated sludge, 7.39; and the purified effluent, 0.15. The results of chromatographic analysis of these materials are given in Table I. In the purified effluent no amino acid could be detected in the free or combined form.

TABLE I

Amino acids in raw sewage and in activated
sludge
(Expressed as mg. per g.)

Amino acids	Raw sewage		Activated sludge	
	in the free form	in the acid hydrolysate	in the free form	in the acid hydrolysate
1 Cystine	Present	9.6	Nil	19.0
2 Lysine and histidine	Present	13.3	0.5	48.0
3 Arginine	Present*	8.7	0.3	26.5
4 Serine, glycine and aspartic acid	Present*	26.5	0.8	51.5
5 Glutamic acid and threonine	Present*	34.5	1.0	69.0
6 Alanine	Absent	14.6	1.1	33.5
7 Proline	Absent	†	Nil	†
8 Tyrosine	Present	7.9	0.6	18.7
9 Tryptophane	Absent	†	0.7	†
10 Methionine and valine	Present*	10.1	1.0	26.5
11 Phenylalanine	Present	9.4	0.6	17.6
12 Leucines	Present*	16.4	1.5	38.9

* Present in slightly higher concentrations than in the other cases but not in estimable amounts.

† Present but was not estimated.

‡ Tryptophane, if present, should have been destroyed during acid hydrolysis.

Rows 2, 4, 5, 10 and 12 give the values for the groups of amino acids as these appear in groups on the chromatogram when developed with *n*-butanol-acetic acid-water as the solvent. The values were obtained by comparing the colour intensities with those obtained by using a mixture of known amounts of the correspond-

ing amino acids in equal proportions. Lysine, histidine, serine, glycine, aspartic acid, glutamic acid and threonine were identified individually by running two-dimensional sheet chromatograms,⁸ which were developed in one direction with phenol saturated with water in an atmosphere of coal gas, and in the other direction with *n*-butanol-acetic acid-water. Methionine was identified by using platinum-iodide reagent, and valine in the methionine-valine band was identified by oxidation of methionine using hydrogen peroxide.⁹

The values for tyrosine in the acid hydrolysate are not corrected for its lower solubility in slightly acid pH range.

The above observations show that (1) raw sewage contains almost all the essential amino acids, (2) during purification by the activated sludge process, the amino acids are concentrated in the sludge, and (3) the purified effluent is practically free from amino acids.

We wish to thank Dr. K. V. Giri for his keen interest in the work.

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Indian Inst. of Sci., G. J. MOHAN RAO.
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March 4, 1953. A. V. S. PRABHAKARA RAO.

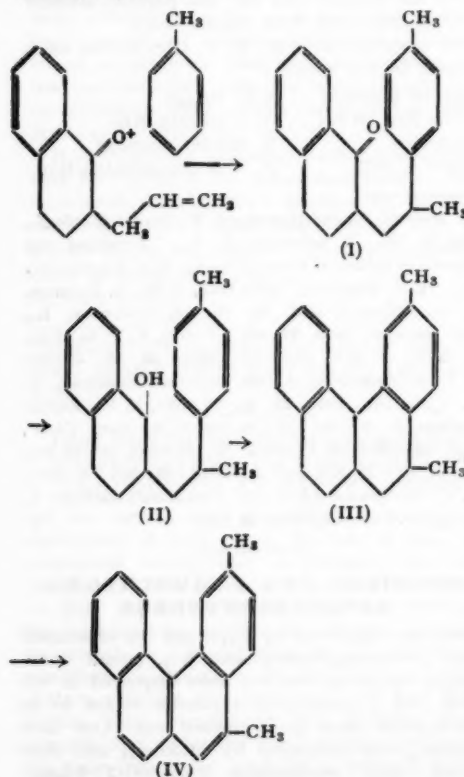
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SYNTHESIS OF 2:3'-DIMETHYL-3:4-
BENZPHENANTHRENE

SINCE the discovery by Cook and his associates¹ that 3:4-benzphenanthrene is a potent carcinogen, much interest has been displayed in this field and a number of synthetic routes to its derivatives have been worked out. One such method was developed by Mukherji and Rao² when they synthesised 2-methyl-3:4-benzphenanthrene. By an extension of this method we have now synthesised 2:3'-dimethyl-3:4-benzphenanthrene.

2-Allyl-1-tetralone² was subjected to aluminium chloride-catalysed reaction^{2,3} with toluene

when 2-[β -methyl- β -(*p*-tolyl)-ethyl]-1-tetralone (I), b.p. 240°/13-14 mm., was obtained in satisfactory yield. Reduction of the above tetralone was effected with aluminium isopropoxide to afford almost a quantitative yield of the corresponding carbinol (II), b.p. 180-82°/1 mm. This carbinol was then cyclised with concentrated sulphuric acid⁴ to give 2:3'-dimethyl-1:2:9:10:11:12-hexahydro-3:4-benzphenanthrene (III), b.p. 180-85°/3-4 mm. Dehydrogenation of this hexahydro derivative with palladium charcoal (30 per cent.) at 300-20° for 4 hours proceeded smoothly to give 2:3'-dimethyl-3:4-benzphenanthrene, b.p. 190-95°/2 mm., as a pale yellow viscous oil, which did not solidify. However, this hydrocarbon gave a deep orange picrate which was crystallised from ethanol, m.p. 146°.



The proof of the *para*-orientation in the Friedel-Crafts product was obtained through alkaline permanganate oxidation of I to a mixture of phthalic and terephthalic acids which were separated by fractional crystallisation from

water. Terephthalic acid was identified as its dimethyl ester, m.p. 140°.

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May 4, 1953.

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POLYFRUCTOSAN FROM *FURCRAEA GIGANTEA* VENT.

It was previously suggested¹ that the qualitative make-up of the water-soluble carbohydrates present in *Agave vera cruz*² might be common to the *Agave* species in general. This suggestion has gained support from the fact that working with the stem juice of *Furcraea gigantea* (Amaryllidaceae),³ we have since obtained for the carbohydrates therein a chromatographic pattern⁴ identical with that from *A. vera cruz*.² Further, characteristics of the polyfructosan isolated from *F. gigantea*, to be described here, are similar to those described for the polyfructosan¹ from *A. vera cruz*.

The stem juice of *F. gigantea*, of the numbers examined, had low optical rotation (from +0.35° to -0.97°), but, as with *A. vera cruz*, became highly levorotatory on mild acid hydrolysis. In common with *A. vera cruz*, the stem juice of *F. gigantea* was also found to be rich in calcium salts.

In contrast to the stem, it was observed that the juice from the bulbels of the plant was much more levorotatory, suggestive of a higher concentration of the polyfructosan therein. So bulbels were chosen for isolating the polyfructosan.

The method of isolation was essentially the same as previously adopted by us for *A. vera cruz*.¹ The bulbels of *F. gigantea* were crushed in an electrical mincer. The juice from the crushed mass was pressed by hand through cloth, heat-coagulated, centrifuged and the green, fibrous residue discarded. To the clear juice thus obtained, ethyl alcohol was added to 60 per cent. concentration (*v/v*). The white, heavy and rather granular precipitate obtained at this stage was removed by centrifuging. To the clear, supernatant solution, a further quantity of alcohol was added to raise its concentration to 80 per cent. in the final solution.

Now a light brown precipitate appeared, which, after separation by centrifuging, was given a wash with 80 per cent. alcohol, dissolved in minimum amount of water and reprecipitated with alcohol by dropwise addition. The precipitate was freed from alcohol under vacuum and finally dried at 110° to remove traces of alcohol, when the material puffed and crumbled to a coarse, almost white powder.

The polyfructosan had the following characteristics:

$[\alpha]_D^{25} = -37.5^{\circ}$, $[\alpha]_D^{25} = -80.2^{\circ}$, after hydrolysis.

On acetylation with acetic anhydride in pyridine⁵ followed by deacetylation with sodium methoxide in methanol,⁶ a material with $[\alpha]_D^{25} -40.0^{\circ}$ was obtained which on hydrolysis gave $[\alpha]_D^{25} -86.2^{\circ}$ (corresponding to that of fructose, allowing for temperature and concentration).

The osazone formed from the hydrolysate of the polyfructosan had a crystal pattern typical of fructosazone, and melted at 204° .

Our thanks are due to Dr. Girdhari Lal for his keen interest in the work and to the Economic Botanist to the Government of Madras for identifying the plant for us.

Central Food Tech. Res. Inst., I. S. BHATIA.
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FORMATION OF MOLYBDENYL FERROCYANIDE COMPLEX

In the present work, conductometric titrations were carried out between sodium molybdate (14.68 g./litre) and potassium ferrocyanide (46.658 g./litre) solutions to ascertain the possibility of complex formation between molybdate and ferrocyanide.¹⁻⁴

Samples of G. R. quality were used throughout the work. Measurements of conductivity were made using a dip-type cell to minimise the error due to volume effect and the temperature was $33^{\circ}\text{C} \pm 0.2$. Direct and reverse

titrations were done using sodium molybdate and potassium ferrocyanide as titrants respectively, and at different conditions. Results (one set) are shown graphically in Fig. 1. Curve (A)

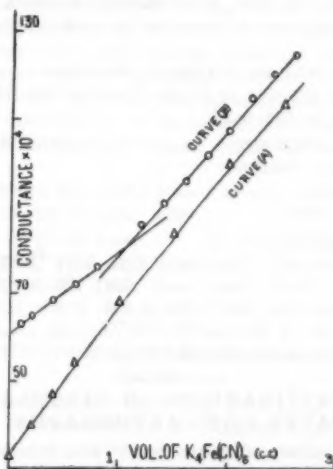
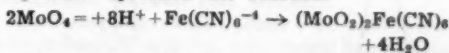


FIG. 1

represents the change in conductance when potassium ferrocyanide solution was added to sodium molybdate solution and this is almost a straight line indicating no complex formation. The pH of the sodium molybdate solution used was 8.2. Next, titrations were carried out starting with sodium molybdate solution at different pH values (obtained by adding different volumes of HCl). The addition of potassium ferrocyanide solution to 200 ml. of sodium molybdate solution containing 0.0587 g. of $\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$ and HCl to keep the initial pH of the solution at 2.96, is represented by the curve (B). This shows a break corresponding to the addition of 1.1 ml. of potassium ferrocyanide solution. This, on calculation, corresponds to an addition of 2 mol. of $\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$ to 1 mol. of $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$. The following equation represents the reaction.



This explains why the complex formation does not take place at higher pH values. According to Jander,⁵ at all pH values higher than the iso-electric point, anionic behaviour of molybdenum is seen. This does not exclude, however, the existence of a certain concentration of cationic molybdenum near about the iso-electric point. Moreover, according to the above equation, hydrogen ions are consumed during the complex

formation and hence the pH should increase more than that warranted by the addition of potassium ferrocyanide solution alone, which is actually found to be so. This, coupled with the formation of the slow-moving complex ion should result in a decrease in conductivity, as observed.

Details will be published elsewhere.

Thanks are due to Dr. S. Pani for his helpful criticism in the work.

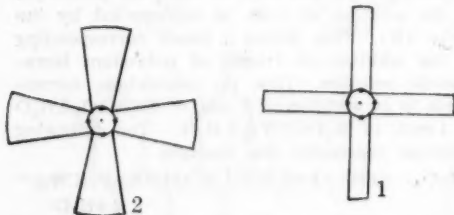
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Ravenshaw College,
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INVESTIGATIONS ON CIRCULAR PAPER CHROMATOGRAPHY

THE R_f values of amino acids¹ and many other substances^{2,3} as determined by circular paper chromatographic technique are higher than those obtained by the unidimensional chromatographic methods. Rao and Giri¹ consider that the movement of amino acids in the former case is directed both in the direction of flow of the solvent towards the edge of the paper and also in the direction orthogonal to the direction of flow of the solvent and hence the movement of amino acids is a two-dimensional movement. The following experiment was designed to test the validity of the assumption.

Out of a filter-paper disc a cross with four equal arms as shown in Fig. 1 is cut out. The



solutions of amino acids are individually applied at the start of each arm on the small circle at the centre. The paper-cross is developed in the same way as in the case of circular technique.⁴ Next, keeping the lengths equal, the arms are made in the form of sectors, gradually widening out from the start at the centre as shown in Fig. 2. The diameter of the inner circle is kept

constant. A number of such paper-crosses are cut out with gradually increasing widths of the four sectors and finally merging into a complete circle. Phenol-water being much less volatile is used as the developing solvent. R_f values so obtained are recorded below:

TABLE I

Developing solvent—Phenol-water; Average distance travelled by the solvent front—6.6 cm.; Radius of the inner circle—1 cm.; Outside radius—7.5 cm.; Initial width of each segment—1.5 cm.

Amino acids	R_f values					
	Descending Technique ⁵	Circular Technique				
Outside width of each segment		cm	cm.	cm.	cm.	Full circle
Aspartic acid	.18-.22	.22	.27	.26	.35	.34
Glycine	.42-.44	.46	.45	.50	.56	.54
Alanine	.56-.58	.65	.68	.71	.72	.72
Phenylalanine	.84-.87	.89	.88	.88	.89	.89

TABLE II

Developing solvent—phenol-water; Average distance travelled by the solvent front—7.3 cm.; Radius of the inner circle—0.5 cm.; Outside radius—8 cm.; Initial width of each segment—0.8 cm.

Amino acids	R_f values					
	Descending Technique ⁵	Circular Technique				
Final width of each segment		cm.	cm.	cm.	cm.	Full circle
Glutamic acid	.30-.32	.33	.45	.46	.47	.46
Serine	.37-.39	.41	.51	.51	.53	.53
Threonine	.50-.53	.53	.62	.65	.66	.65
Valine	.76-.78	.76	.82	.83	.84	.84

It is clear from the above that horizontal development of a paper-cross with arms of uniform width is identical with unidimensional development. Spots and not arcs due to the amino acids are formed as in the latter case. The R_f values obtained on such a cross are comparable, as is evident from the table, with those obtained by descending technique. But with gradual widening of the arms, the spots tend to be elongated along the width and form into arcs. The R_f values too, gradually increase and finally merge into the values obtained with circular technique. Discrepancies observed in certain cases are within experimental error.

This signifies without doubt that orthogonal distribution of the solvent is responsible for the

higher R_f values in case of circular technique, as assumed by Rao and Giri.¹ More detailed investigations with the technique of circular paper chromatography are being carried out which will be published elsewhere.

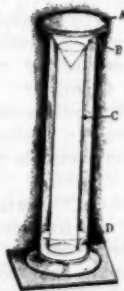
Our sincerest thanks are due to Dr. D. M. Bose and Dr. J. K. Chowdhury, for their kind interest and continued encouragement.

Dept. of Chemistry, H. C. CHAKRABORTY.
Bose Research Institute, D. P. BURMA.
Calcutta, June 6, 1953.

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A SIMPLE DEVICE TO KEEP CYLINDERS OF PAPER INSIDE GLASS CYLINDERS FOR PAPER CHROMATOGRAPHY

THE filter-paper on which the material to be chromatographed has been spotted is made into a cylinder by stitching the folded edges with a piece of thread. The diameter of this cylinder will be about $\frac{1}{2}$ – $\frac{3}{4}$ " less and its height about 1" less than that of the glass cylinder. A circular filter-paper is folded into a cone and then placed with the tip of the cone inside the paper cylinder and the rim flush with the top of the glass cylinder. The solvent mixture is placed at the bottom of the glass cylinder and the groundglass cover is then placed on the top of it. Since both the spotted paper



A. Ground glass cover. B. Filter-paper cone. C. Filter-paper cylinder. D. Solvent mixture. and the filter-paper cone have a circular cross-section, the paper cylinder is held exactly central leaving a clear annular space between the

glass and paper cylinders (*vide sketch*). As an additional precaution to ensure that the paper cylinder does not touch the sides of the glass cylinder and the annularity between the two cylinders is maintained, a ring made of glass rod or tubing, or a shallow flat dish of the shape of a Petri dish with internal diameter slightly larger than that of the paper cylinder may be placed at the bottom of the glass cylinder. The shallow dish can be made in the laboratory by cutting a beaker or reagent bottle of suitable size.

The device described above is very useful in paper chromatographic work.

Division of Fruit Tech., G. S. SIDDAPPA.
Central Food Tech. Res. Inst., B. S. BHATIA.
Mysore, June 10, 1953.

2:4-DINITRO-6-NITROSO-BENZOIC ACID

SACHS AND EVERDING¹ and later Secareanu² have reported the formation of 2:4-dinitro-6-nitroso-benzoic acid by prolonged exposure of a solution of 2:4:6-trinitro-benzaldehyde in benzene, to sunlight. They have described the material as of yellow brown colour, M.P. 229° (decompn.). The yellow brown solid which we obtained on repetition of the above work, was different from a nitroso-dinitro-benzoic acid as shown by its analysis, equivalent weight and molecular weight.

We have now found that 2:4-dinitro-6-nitroso-benzoic acid separates in the form of beautiful green needles after a short (2 hours) exposure of a saturated solution of 2:4:6-trinitrobenzaldehyde in dry benzene, to sunlight. The pure green-coloured acid melts at 200.5°. It is easily soluble in water (*vide infra*), ethyl alcohol, ether, ethyl acetate, hot benzene and the solutions are green. It is insoluble in carbon tetrachloride. It gives the characteristic reactions of a nitroso compound. (Found: N, 17.4 per cent; equi. wt. 240; mol. wt. 239; required for $C_7H_3N_3O_7$; —N, 17.43 per cent; equi. wt. 241; mol. wt. 241.)

On warming with water 2:4-dinitro-6-nitroso-benzoic acid has been found to condense rapidly to 2:2'-dicarboxy-3:3'-5:5'-tetranitro azoxybenzene, M.P. 245° (decompn.), whose structure was confirmed by analysis. (Found: —N, 18.1 per cent; equi. wt. 230.2; $C_{14}H_6N_6O_{13}$ requires N, 18.03 per cent; equi. wt. 233) and by decarboxylation to the known³ 3:3'-5:5'-tetranitro-azoxybenzene.

2:2'-dicarboxy-3:3'-5:5'-tetranitroazoxybenzene was further found to be identical

(analysis, mixed m.p. and infra-red spectrum) with the 'white compound' which is a byproduct of continuous T.N.T. manufacture, and whose constitution was so far not established. A tricyclic structure—Tetranitro-dicarboxy-phenazine-N-oxide has been proposed for the white compound.⁴ That the white compound has an azoxy structure is now conclusively proved from the following evidence:—

(i) The white compound is formed from 2:4-dinitro-6-nitroso-benzoic acid by elimination of oxygen. The tricyclic structure based on phenazine N-oxide would require elimination of a water molecule.

(ii) The composition of the white compound, especially its hydrogen content, agrees with that required for an azoxy compound (Found H, 1.31 per cent.; required for $C_{14}H_6N_6O_{13}$, 1.29 per cent.; for $C_{14}H_4N_6O_{13}$, 0.86 per cent.).

(iii) The infra-red spectrum of the white compound does not show the presence of a tricyclic structure.

(iv) Formation of azoxy compounds through intermediate nitroso compounds in photodecomposition of aromatic Nitro-aldehydes is known.^{5,6}

(v) The decarboxylated 'white compound' is identical with 3:3'-5:5'-tetranitroazoxybenzene prepared directly from trinitrobenzene.³

The yellow brown substance obtained according to Sachs and Everding's¹ or Secareanu's² procedure was also found to be crude 2:2'-dicarboxy-3:3'-5:5'-tetranitroazoxybenzene. Smooth condensation to azoxy compounds appears to be a general reaction of ortho-nitroso benzoic acids. 2:2'-dicarboxy-5:5'-dinitroazoxybenzene has similarly been obtained from 2-nitroso-4-nitrobenzoic acid.

Incidentally, it has been found that an azoxy group requires only four equivalents of titanous chloride for reduction instead of the expected six. This indicates that the -N=N- linkage is reduced prior to the N→O linkage and the intermediate hydroxylamine rearranges to the para-amino-phenol, in the acid-reducing medium.

Thanks are due to Shri B. B. Chaudhuri, S.D.M.E., for his interest and encouragement, and to the Director of Technical Development, M.G.O. Branch, Army Headquarters, New Delhi, for permission to publish the results.

Technical Development S. A. JOSHI.
Establishment, W. D. PATWARDHAN.
Military Explosives,
Kirkree, Poona-3, June 3, 1953.

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SYNTHESIS OF CYCLOHEXYLIDENE ACETALDEHYDE BY KRÖHNKE'S METHOD

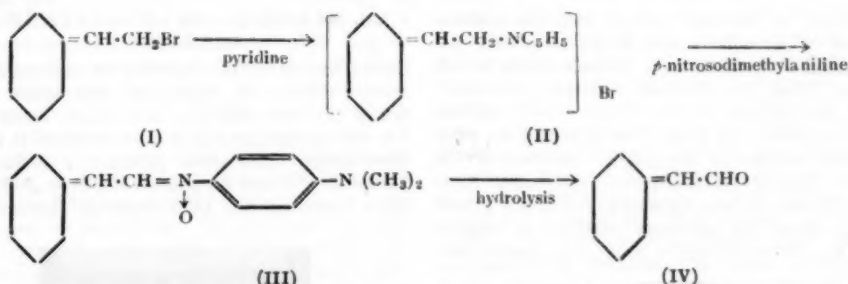
KRÖHNKE¹ has described a reaction by which halogen compounds of the formula $RCOCH_2X$ and $RHC=CH.CH_2X$ have been converted to the corresponding aldehyde $RCOCHO$, $RHC=CHCHO$. The reaction consists in the addition of the halogen compound to pyridine, transformation of the pyridinium salt with *p*-nitrosodimethyl aniline to a nitron and hydrolysis of the latter with acid.

This elegant method was successfully employed for the synthesis of phytenal, farnesal, 3, 7, 11-trimethyl-dodecæn-(2)al(1)² and of 3-acetoxy-pregnadien-(5, 17)-al-(21) and pregnadien-(4, 17)-one (3)al(21)³. The synthesis of cyclohexylidene acetaldehyde (IV) from β -cyclohexylidene ethyl bromide (I) by Kröhnke's method is reported here.

Cyclohexylidene acetaldehyde has been prepared previously by oxidation of β -cyclohexylidene ethyl alcohol⁴ and also by ozonisation of 1-allyl cyclohexanol and dehydration of the resulting 1-hydroxy cyclohexyl acetaldehyde to a mixture of cyclohexylidene acetaldehyde and cyclohexenyl acetaldehyde.⁵ Rupe⁶ had claimed to have obtained this aldehyde by rearrangement of 1-ethinyl cyclohexanol with formic acid. But later workers^{7,8} proved beyond doubt that the product thus formed was 1-acetyl 1-cyclohexene and not cyclohexylidene acetaldehyde. That cyclohexylidene acetaldehyde also was formed, in traces, along with 1-acetyl-1-cyclohexene during the rearrangement was proved by Chanley.⁸

In the present study, cyclohexanone was condensed with acetylene in liquid ammonia in the presence of sodium acetylide to get 1-ethinyl cyclohexanol. This carbinol was partially hydrogenated over $Pd.CaCO_3$ catalyst to 1-vinyl cyclohexanol which on treatment with PBr_3 gave β -cyclohexylidene ethyl bromide⁴ (I). This unsaturated bromide was converted to the pyridinium compound (II) by treatment with excess of anhydrous pyridine. The pyridinium compound on treating with *p*-nitrosodimethyl aniline gave the corresponding nitron (III) which on hydrolysis with dilute HCl gave cyclohexylidene acetaldehyde,

1. Sachs and Everding, *Ber.*, 1903, **36**, 962. 2. Secareanu and Lupas, *Bull. Soc. Chim.*, 1936, **3** (5), 1161-



characterised by its semicarbazone (m.p. 210° d.) and 2, 4-dinitrophenylhydrazone (m.p. 201-02° d.). The latter derivative has not been reported before. The intermediates (II) and (III) were not isolated in pure form. The yield of the aldehyde was very poor.

Synthesis of methyl-cyclohexylidene acetaldehydes are being attempted on similar lines.

Dept. of Organic Chemistry, M. C. CHACO.
Indian Institute of Science, B. H. IYER.
Bangalore-3, June 22, 1953.

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CORPUS ALLATUM IN *IPHITA LIMBATA* STAL.

The corpora allata are well known as endocrine organs of insects having important roles in growth, moulting, metabolism and reproduction. A comparative account of the glands is given by Nabert¹ and Cazal² and the physiology of these has been discussed by Wigglesworth,³ Scharrer⁴ and Thomsen.⁵

In *Iphita limbata* Stal. (Pyrrhocoridae: Hemiptera) the corpus allatum is a median, transparent, somewhat flattened, circular body, lying near the anterior extremity of the aorta, behind the hinder edge of the brain and over the gut. In the adult male it is a small, rounded body measuring about, on an average, 450 microns in diameter. In the young female, it

is larger measuring about 600 microns in diameter. In the female there is a gradual increase in the size of the corpus allatum as mating begins and it reaches its maximum size when the female becomes gravid with the abdomen distended with eggs. As it grows, the rounded gland becomes roughly bilobed and then swells up into a circular, somewhat flattened disc-like body. In this stage, it measures about 750 microns in diameter. After oviposition, the corpus allatum shrinks to the original size.

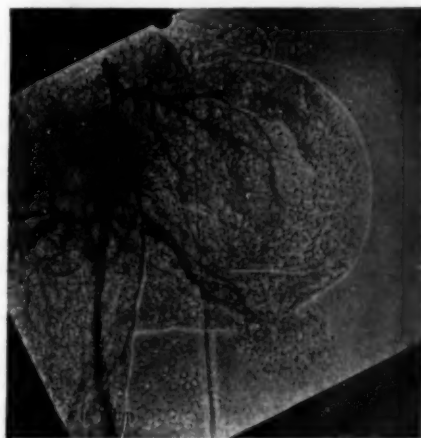


FIG. 1. Live corpus allatum from gravid female of *Iphita limbata* Stal., under the phase contrast microscope—Unstained.

Palm⁶ discusses about the sexual differences in size and structure of the corpus allatum in some insects and points out that in many examples, the gland is larger in the females.

The entire gland under the low power of the microscope shows that it is invested by a thin, membranous envelope which gets easily punctured and appears to be of fibrous nature. It is perfectly transparent under ordinary microscope, but under the phase contrast microscope

it reveals its cellular nature and the copious amount of secretion within as granules (Fig. 1). The gland is supplied by a tracheal trunk which springs from the trachea running posteriorly from the surface of the brain; this tracheal trunk is short and gives rise to a few tracheae over the surface of the gland. Sections of the corpus allatum (dichromate-formal-acetic fixation followed by iron hæmatoxylin) of the gravid female show the secretory product in quantities (Fig. 2) which stains blue and appears gra-



FIG. 2. Section of the same. Fixation in dichromate formal-acetic and stained in Heidenhain's iron hæmatoxylin. The large reniform body is the gland with the granular secretion collected on one side. The circular section adjacent to the gland is the aorta.

nular. The cells are fairly large with large nuclei, blue chromonemata and nucleoli. The cell limits are generally obsolete but the structure is not syncytial. The secretory product in the gland is Gomori-positive.

The role of the corpus allatum in female reproduction and the relation between neurosecretion and the corpus allatum in *Iphita limbata* Stal., are under investigation by experimental means.

Zoological Laboratories,
University College,
Trivandrum, April 20, 1953.

K. K. NAYAR.

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Co. 560 AND Co. 561: SUGARCANE OR SORGHUM?

CHONA AND MUNJAL¹ reported the occurrence of *Sphacelotheca* on sugarcane, the actual hosts being Co. 560 and Co. 561 which along with Co. 559, are progeny of a cross between G 1227 ♀ [*Saccharum officinarum* (Vellai) ♀ × *Sorghum halepense* ♂] and *Sorghum halepense* ♂ (Fig. 1). As a result of this back-crossing, characteristic

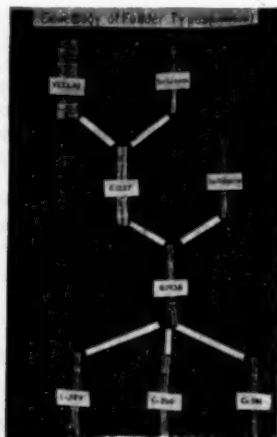


FIG. 1

features of sugarcane have been so drastically whittled down that the varieties in question (Fig. 2), resemble, to a very great extent, their grandfather, *Sorghum halepense* which was crossed with a noble cane to evolve "fodder canes" with reduced content of hydrocyanic acid.



FIG. 2

The distinguishing features of "Sugarcane" to which all the varieties of the three species of *Saccharum*, viz., *S. officinarum*, *S. barberi* and *S. sinense* and a majority of their progeny

belong, are (1) a morphological make-up, so characteristic of all the three species, and (2) a high percentage of easily recoverable sucrose in them. The occurrence of one or the other in a plant does not merit this name as was the case in a form of *Saccharum spontaneum* which was found to contain as high as 13 per cent. sugar in juice but not commercially available, as against 16-20 per cent. in sugarcane.² Co. 560 and Co. 561 have none of these attributes of sugarcane. To call them by this name, and to assign them to *Saccharum officinarum* would be something like calling Co. 563* and Co. 564, bamboos and placing them under *Bambusa arundinacea* which obviously is not correct.

It would, therefore, appear that the occurrence of *Sphacelotheca* on sugarcane has still to be recorded. So far, it has been noted on *Erianthus munja*³ amongst the plants belonging to the subtribe *Saccharineae*.

The author is indebted to Sri. N. L. Dutt for kindly supplying photographs reproduced as Figs. 1 and 2, and to Sri. K. L. Khanna for his keen interest in this note.

Central Sugarcane Res. Station, S. L. SHARMA.
Pusa, Bihar, January 9, 1953.

* Parentage of Co. 563 and Co. 564 is :—
Co. 349 ♀ × Bamboo hybrid IX ♂ which is one of the F₂ seedlings of a cross between P. O. J 213 ♀ and *Bambusa arundinacea* ♂.

1. Chona, B. L. and Munjal, R. L., *Curr. Sci.*, 1951, 20, 301. 2. Venkataraman, T. S., *Sci. Rep. Imp. Agri. Res. Pusa*, 1934-35, p. 92. 3. Khanna, K. L. and Ramanathan, K. R., *Curr. Sci.*, 1946, 15, 253.

PRELIMINARY OBSERVATIONS ON A VIRUS DISEASE OF *THEVETIA* *NERIIFOLIA* JUSS.

PLANTS of *Thevetia neriifolia* Juss., growing as a hedge in Minto Road area of New Delhi, were observed during July 1948, to show severe smalling and curling of leaves. The leaf-margins in some cases were curled inwards or outwards. In most of the leaves, however, the margins were wavy and presented a more or less serrated appearance. There were fine chlorotic streaks running mostly along the finer veins and concentrated in the area adjoining the midrib or near the margins giving the leaf a unique pattern. The incidence of the disease in the locality was almost 100 per cent.

All experiments were conducted in an insect-proof house. Several attempts made during different periods of the year to transmit the disease by sap inoculation on young healthy

plants of *Thevetia neriifolia* Juss. raised from seed gave negative results. Also, the disease could not be transmitted by sap inoculation in the presence of carborundum powder to healthy plants of *Nicotiana tabacum* L., Varieties White Burley and Harrison's Special, *Nicotiana glutinosa* L., *Lycopersicum esculentum* Mill., Variety Sutton's Early Market, *Datura stramonium* L., *Capsicum annuum* L., *Solanum nigrum* L., and *Solanum nodiflorum* Jacq. The disease was, however, successfully transmitted by wedge grafting to *Thevetia neriifolia* Juss., *Datura stramonium* L., *Nicotiana tabacum* L., Varieties White Burley and Harrison's Special, and *Lycopersicum esculentum* Mill., Variety Sutton's Early Market.



Two to three weeks after grafting, young leaves on *Thevetia neriifolia* showed curling of the leaf-tips downwards or sideways accompanied by smalling of the leaves, asymmetry of leaf lamina and waviness of leaf-margins giving them a more or less serrated appearance. This was followed by the development of chlorosis along the finer veins mostly near the midrib, but in some cases starting from the leaf-margins and proceeding inwards towards the midrib. Later, all the above symptoms became more prominent. Fig. 1 shows a *Thevetia neriifolia* plant showing the symptoms of the disease transmitted to it by grafting. *Datura stramonium* plants about three weeks

after grafting showed rolling of leaf-margins inwards, curling of leaves downwards and interveinal yellowing. This was followed by wrinkling of the leaf-surface. Later on all these symptoms became more intensified except the inward rolling of the leaf-margins. Leaves subsequently developed showed marked smaling. Similar symptoms were observed on *Lycopersicum esculentum*. In the case of *Nicotiana tabacum* the symptoms produced were very mild, such as slight downward curling and faint mottling.

As the disease could be transmitted by grafting only, an attempt was made to determine the insect vector. Preliminary attempts aimed at transmission of the disease with aphids (*Myzus persicae* Sulz.) and white flies (*Bemisia tabaci* Gen.) were not successful and the vector of the disease still remains to be discovered.

As no record of a virus attacking *Thevetia nerifolia* is available, it will be interesting to continue the investigations further.

These experiments were conducted at the Division of Mycology and Plant Pathology, Indian Agricultural Research Institute, New Delhi, and I am grateful to Dr. R. S. Vasudeva for his keen interest in the work.

Dept. of Botany,
Holkar College, Indore,
March 30, 1953.

R. P. GARGA.

ON THE OCCURRENCE OF A NEW SPECIES OF *COLLETOTRICHUM* ON *POTHOS SCANDENS* L.

DURING a routine visit to a neighbouring garden a fairly severe leaf-blight disease was noticed on *Pothos scandens* L., a common creeper. Occasionally two species of *Colletotrichum* were found associated with the disease, one of which resembled *C. capsici* (Syd.) Butler and Bisby. The other species differed in several morphological characters, such as the size and shape of conidia, conidiophores, setae and acervuli, from *C. pothi* Koorders once recorded on *Pothos* sp. from Java.⁴ Similarly, it also differed from some other species of the fungus reported on various members of Araceae from different countries.^{1,2,3,5} In view of the above, it is proposed here as a new species whose diagnosis follows:

Acervuli ut plurimum epiphylli, nonnumquam etiam in petiolis foliorum infectorum, brunnei, submersi, separati, diam. 59.5-164 μ , setosi vel asetosi. Setae plures cum adsunt, brunneae, generatim curvatae, nonnumquam fere ad angulum rectum, longiores quidem ad angulum rectum approximantes, continuae, vel semel vel bis septatae, fastigiatæ ad apicem, 31.5-88 μ

longae, 5 μ latae ad basim. Conidiophori hyalini, continui, cylindrici, 6-9.5 μ longi, 1.5 μ lati. Conidia hyalina, continua, oblonga vel plus minusve cylindrica, occasionaliter tenuiter constricta ad medium atque vel tenuiora ad apicem unum, 9.5-19 \times 4-6 μ .



Colletotrichum cylindricum sp. nov. (Figs. 1-4).

FIG. 1. Seta, FIG. 2. T. S. Acervulus, FIGS. 3 and 4. Conidiophores and Conidia.

Typus lectus in foliis et petiolis *Pothos scandens* Linn. in urbe Poona, die 9 januarii, anni 1952, a cl. S. N. S. Srivastava. Typus positus etiam in Herb. I.M.I., Kew, England (No. 49133.)

The writer is grateful to Dr. S. P. Wiltshire for some suggestions, and to Dr. P. R. Mehta for advice and encouragement during the course of this work. Thanks are also due to Rev. Father H. Santapau for the Latin rendering of the diagnosis.

S. N. S. SRIVASTAVA.

Directorate of Plant Protection,
Quarantine and Storage,
Plant Quarantine Station,
Poona, March 30, 1953.

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AN EURYTOMID HYPERPARASITE ON *STENOBRACON DEESAE* (CAM.)

Stenobracon deesae (Cam.) is a well-known larval Braconid parasite of the sugarcane and jowar borers. Recently, a Eurytomid hyperparasite has been found to parasitize the pupae

of *Stenobracon* in Delhi. So far, except for a pteromalid hyperparasite recorded by Narayanan¹ and others, there is no record of any other hyperparasite attacking *Stenobracon*.



FIG. 1. Eurytomid female, $\times 15$.

FIG. 2. *Stenobracon* cocoon showing exit hole of hyperparasite.

FIG. 3. *Stenobracon* cocoon healthy showing exit hole of parasite.

FIG. 4. *Stenobracon* cocoon cut open to show pre-pupal remains.

Lettering:—eh., exit hole; prp.r., *Stenobracon* pre-pupal remains.

From a number of *Stenobracon* pupae collected in the field, it was observed that two of them were pale brown in colour as against the normal pale white healthy cocoons. From one of these cocoons, 8 female and 3 male hyperparasites emerged. From the second cocoon, 4 females emerged. The 4 unmated females were given *Stenobracon* pupae that were in different stages of development for oviposition. It was observed that the female parasite started laying eggs a few hours after emergence if a host of suitable stage was provided. The hyperparasite selects the pre-pupal stage of *Stenobracon* for oviposition. The female pierces the tough parasite cocoon with its long curved but concealed ovipositor and lays eggs on the body of the host. The hyperparasite is definitely an external parasite, as the hyperparasitized *Stenobracon* cocoon when cut open shows pre-pupal host remains (Fig. 3, prp.r.).

Only one small exit hole (Fig. 2, eh.) is bitten through and all the hyperparasites emerge out of the same hole. The parasite completes its life-cycle in about 13 to 15 days at 25° C. temperature and 70 per cent. relative humidity. Five *Stenobracon* cocoons were parasitized by the 4 unmated females and the progeny consisted of 61 males. Undoubtedly, the hyperparasite is capable of reproducing parthenogenetically.

This is the second record of another species of hyperparasite on this beneficial parasite. As the hyperparasite is highly prolific, the authors feel that the discovery of this hyperparasite on *Stenobracon* emphasises the need for examining the material more carefully before introducing the parasite in the field. Further work on the systematic aspect is in progress.

Division of Entomology, E. S. NARAYANAN.
Indian Agricultural B. R. SUBBA RAO.
Research Institute,
New Delhi, April 2, 1953.

1. Narayanan, E. S. and others, *Curr. Sci.*, 1951, 20, 300-01.

NOTE ON *CHARACIOSIPHON RIVULARIS* IYENGAR FROM GWALIOR

THE genus *Characiosiphon* was described by Iyengar¹ who found the alga growing in tiny stones and pebbles inside the water in a shallow stream near Trichinopoly in South India. The author recently collected this alga in a channel in Gwalior. It was growing on different submerged objects such as leaves, twigs and pebbles in the shallow margins of the channel (Fig. 1). It kept growing in the

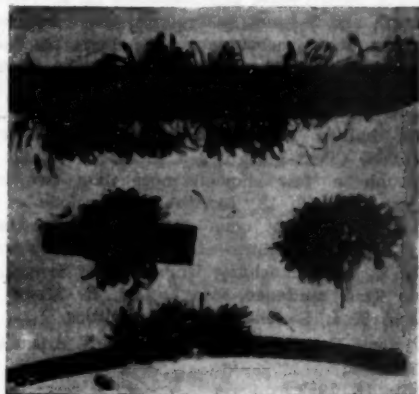
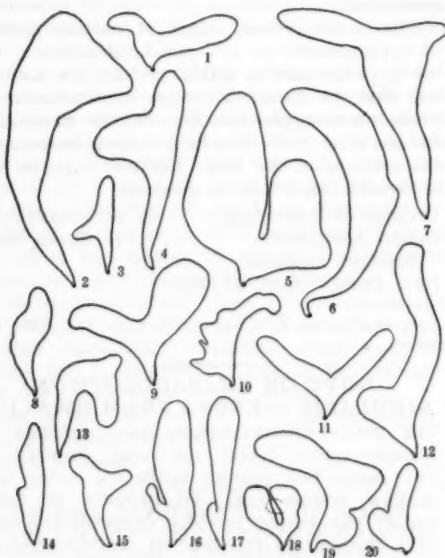


FIG. 1. Habit photographs of *Ch. rivularis* (about ½ nat. size).

channel for four months (September-December 1952) and then disappeared. The alga showed some new and interesting features.

The alga in all its features agrees with the type species. The thallus is cylindrical when young and becomes club-shaped later on. The alga is cœnocyctic with numerous discrete protoplasts which are exactly similar to those described by Iyengar.



TEXT-FIGS. 1-20. Thalli showing different kinds of lobation of the thallus ($\times 25$).

The Gwalior alga is more robust than the South Indian form and measures up to 1 cm. in length and 3-4 mm. in breadth, while the South Indian form measures up to 1 cm. in length and only up to 1 mm. in breadth. The Gwalior form is particularly interesting in the fact that some of the individuals showed a lobation of the thallus. These individuals are generally bilobed (Text-Figs. 1, 3-5, 9, 11, 12, 16, 17, 20) though a few showed more than two lobes (Text-Figs. 10, 18, 19). Such lobations of the thallus have not been described by Iyengar.

The author expresses his grateful thanks to Dr. T. V. Desikachary, University of Saugar, for his kind guidance, and to Dr. R. Misra and Prof. K. L. Saxena for kind facilities.

Victoria College,
Gwalior,
May 13, 1953.

M. S. AGARKAR.

A NEW SPECIES OF ARTHURIA

A LEAF rust on *Glochidion* sp. collected at Mahabaleshwar, Bombay, proved on examination to belong to the rust genus *Arthuria* Jackson, on account of the presence of sub-cuticular pycnia, cœmoid aecia, uredia with urediospores developed in chains and telia with chains of one-celled hyaline teliospores, compacted together into a crust. Comparative studies indicate that *Arthuria* species on *Glochidion* differs in structure and spore measurements from the other known species of this genus, viz., *Arthuria catenulata* Jackson and Holw., *A. columbiana* (Kern and Whetzel) Cumm.¹ and *A. tylophoræ* Ramakrishnan.² It is, therefore, proposed to establish a new species, viz., *Arthuria glochidionis* Gokhale, Patel and Thirumalachar, the details of which are given below:—

Arthuria glochidionis Gokhale, Patel and Thirumalachar, spec. nov.

Infectionis macellæ ut plurimum in foliis, in petiolis quoque atque culmis succulentis, circulares vel polygonales, rosaceobrunneæ, 3-5 mm. diam. Pycnia subcuticularia, amphigena atque caulicola, luteole, brunnea, 105-230 μ lata, absque paraphysibus ostiolaribus. Aecia pycniis consociata, cœmoidea, absque serie peridiali, amphigena, alba, erumpentia atque pulverulenta; aeciosporæ in catenis, subglobosæ vel polygonales, incolore, 33 \times 26 μ (26-40 \times 21-32 μ) parietibus dense verrucosis. Uredia hypophylla, dispersa, aeciis similia structura, subepidermalia, erumpentia; urediosporæ catenulatæ, aeciosporis similes figura sed illis minores magnitudine, viz., 25 \times 18 μ (21-31 \times 17-20 μ). Telia hypophylla, urediis consociata, apparentia ut minutæ crustæ luteolo-brunneæ, producta ex catenulis basipetalibus, catenulis lateraliter coalescentibus atque efformantibus crustam compactam; sporæ maturæ subglobosæ vel cuboideæ, tenuibus parietibus præditæ, leves, 30 \times 19 μ (23-39 \times 17-23 μ) germinantes absque quietis spatio per promycelium externum ornatum 4 sporidiis.

Typus lectus in foliis *Glochidionis* spec. in loco Mahabaleshwar, Bombay, a V. P. Gokhale, mensa junio anni 1952.

Details will be published elsewhere.

College of Agriculture,
Poona-5, May 26, 1953.

V. P. GOKHALE.
M. K. PATEL.

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RELATION BETWEEN ANATOMICAL CHARACTERS AND CHROMOSOME NUMBERS IN *SACCHARUM* *SPONTANEUM* L.

Saccharum spontaneum L. is known to be a compound species, consisting of two sub-species and a number of varieties and to show a wide degree of variation. Chromosome counts of a number of clones have been recorded^{1,2} and the occurrence of polyploidy within the species has been observed and discussed.^{3,4} Since then over 200 variants have been collected by the Spontaneum Expedition Scheme⁵ from various parts of the Indian Union and over a 100 imported from other parts of the distribution area. Haploid chromosome numbers have been determined by clear counts made on iron-acetocarmine smears of pollen mother-cells of about 100 variants. These counts show what appears to be a polyploid series ($n = 24, 32, 40, 48, 56$ and 64) with aneuploid forms occurring in three of the groups ($n = 24, 32$ and 64) of the series.⁶ The following anatomical and other characters were studied by the writers in relation to these chromosome number groups: (1) diameter of the pollen-grains, (2) size of the stomata (long dia. \times short dia.) of the lower and upper epidermes of the lamina, and (3) width of long cells of the epidermis of the internode. All the variants available in each group (Table I) were included in the study; in the $n = 32$ group, however, out of the 70 variants available, a sub-sample of 14 forms covering the geographical range of the species was studied. Means were worked out for 30 readings in each case.

TABLE I

Chromosome group $n =$ No. of variants studied	Pollen-grain diameter (in microns)	Size of stomata (in microns)		Width of long cells in stem epidermis (in microns)
		Lower epidermis	Upper epidermis	
24 4	45.9 \pm 0.34	896 \pm 10.2	802 \pm 8.8	10.3 \pm 0.97
32 14	47.3 \pm 0.42	1188 \pm 5.0	1197 \pm 4.7	12.0 \pm 0.92
40 6	50.5 \pm 0.33*	1310 \pm 8.9	1295 \pm 9.5	13.7 \pm 0.84
48 2	†	1348 \pm 21.7	1459 \pm 20.3	14.1 \pm 1.06
56 4	52.8 \pm 0.62	1516 \pm 11.9	1570 \pm 13.2	16.6 \pm 1.53
64 3	63.3 \pm 0.50	1814 \pm 22.1	1773 \pm 21.5	20.4 \pm 1.96

* Mean for 2 variants, the rest failed to flower.

† These variants failed to flower.

These anatomical data (Table I) show a positive relationship between the dimensions of the cells and the chromosome number. In the case of characters (1) and (2) the differences between the group means have been found to be statistically significant. In the case of (3), the intra-group variation is wide and even though there is an increase in cell width with progressive increase in ploidy, the differences have not come out significant with the present sample.

Treating the pollen-grain as a simple sphere, it is found that for a 100 per cent. increase in chromosome number (as between the $n = 32$ and $n = 64$ groups), the increase in cell volume is 140 per cent., which is much larger than what has been recorded in *Poa*.⁷

Further work is in progress.

Thanks are due to Shri N. L. Dutt and R. R. Panje for their help and guidance.

Sugarcane Breeding J. T. RAO.
Institute, A. BALASUBRAMANIAN.
Lawley Road P.O.,
Coimbatore, May 26, 1953.

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NODOSTOMA BENGALENSE DUV. VAR. A NEW EUMOLPID PEST OF JUTE

Nodostoma bengalense Duv. var. was first observed attacking jute plants (*Corchorus olitorius*) during June 1952 along with *Cleoporus lefevrei* Duv.



FIG. 1

The species *bengalense* was first described by Duvivier¹ in 1891 and Jacoby² records the habitat to be Bengal and Burma, but without mentioning the host plants. The insects are

about 4½ mm. in length. Thorax with few punctures, with the sides produced to form a rather sharp angle. Body with dull yellow-coloured and partly punctured elytra. A few punctures on the head. Antennae eleven-jointed, filiform. Base of the elytra strongly raised, with a deep depression below containing a few deep punctures (Fig. 1). The posterior portion of the wings rather deeply pigmented, which, when folded in impart a blackish colour to the hinder parts of the elytra.

Though these insects were feeding along with the *C. lefevrei* on the same plants, their attacks were restricted to the leaves only, while *C. lefevrei* was seen to feed on the bark of the plants also. During 1952, attack by *N. bengalense* was reported from one place only, and the pest was controlled quickly by spraying with DDT. No phytotoxic effect due to spraying was noticed on the plants.

It may be mentioned that the authors have already recorded another Eumolpid *C. lefevrei* Duriv. as a pest of jute in West Bengal during 1951.³

The authors wish to express their indebtedness to the Commonwealth Institute of Entomology, London, for kindly identifying the insects. Sincere thanks are also due to Sri. B. K. Bera for valuable help.

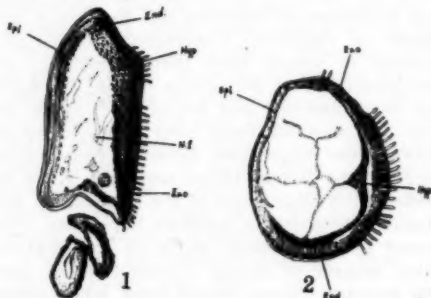
State Agricultural SAURENDRANATH BANERJI.
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Tollygunge,
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THE MORPHOLOGICAL STRUCTURE OF THE FIRST TARSAL JOINT OF THE HIND LEG IN *PYRILLA PERPUSILLA* WALK., AND ITS BEARING ON SUSCEPTIBILITY TO INSECTICIDES*

The epicuticle (Fig. 1, Epi), as also the exo-cuticle (Exo) of the first tarsal joint in *Pyrilla perpusilla* Walk., is as usual uniformly thin but distinct throughout. The outer wall of the epicuticle is, however, peculiar in that it is traversed by a series of rather thick spatulate setae slightly curved at the tip, which appear to pass through the more or less undifferentiated endocuticle and thus reach inwardly the surface of the well-developed series of elongated ovoidal hypodermal cells (Hyp) arranged in a thick more or less well distributed layer. The nuclei

of these cells are distinct and are stained deep blue with hæmatoxyline. The layer of hypodermal cells extends from the dorsal margin of the first tarsal joint along the external wall right upto the ventral part but is conspicuously reduced and becomes undifferentiated on the inner wall (Fig. 2).



Since the series of hypodermal cells in layers on the outer wall of the first tarsal joint is situated just below the epi- and exo-cuticular layers which are traversed by deep-rooted specialized setae mentioned above and moreover, as there is every likelihood of the lipid layer of the epicuticle being continuously abraided by the frequent jumping habit of the Fulgorid, it is likely that the penetration of the water dispersible insecticide particles (B.H.C., and solutions of nicotine sulphate) through the cuticle and subsequently along the roots of the setae right upto the vital hypodermal cells becomes a possibility, thus resulting in the death of the insect. The average results obtained indicate in general that the insecticides applied on the first tarsal joint are definitely more effective than those applied on the thorax. Similar morphological studies in this direction by Slifer¹ indicated that the undersurface of the arolia of *Melanoplus differentialis* (Thomas) lacked the protective layer of cement which in other areas of the leg protects the waterproof lipid film present in the outermost layer of the cuticle. Slifer thus concluded that because of the absence of the cement layer, the wax on the ventral surface of the arolium is easily dissolved by lipid solvents, and the inner layers which remain there, offer little resistance to the penetration of various materials including dyes and insecticides. It is also likely that these protective layers become denuded by abrasive action specially on the arolia (*Euplantulae*) of the true phytophilous type, such as *M. differentialis* as also on the first tarsal joint of the hind leg of a similarly active phytophile-*Pyrilla perpusilla* Walk. The finding of

Slifer also supports the experimental results obtained by Kennedy, Ainsworth and Toms.² Slifer's³ experiments conducted later indicated a similar absence of cement layer from other cuticular areas, viz., the antennal crescents, fenestrae, etc., in *Locusta migratoria migratorioides* R. & F., where the outer layers are similarly thin as in the case of first tarsal joint of *Pyrilla perpusilla* Walk., but the cellular layer beneath the antennal crescent in *Locusta migratoria migratorioides* R. & F., appears to be less prominent and more uniformly arranged when compared to that of the first tarsal joint in the hind leg of *P. perpusilla*. It is, however, not known as yet whether these thermoreceptive areas with their poorly sclerotized cuticle, lacking in a cement layer, as described by Slifer, are also regions vulnerable to aqueous suspensions of insecticides. Attempts are also being made to trace similar areas in various stages of *Schistocera gregaria* Forsk., with a view to find out their response to various insecticides.

Ind. Agric. Res. Inst.,
New Delhi,
May 26, 1953.

S. MUKERJI.
V. G. PRASAD.

* The problem involved formed part of the thesis of be Junior Author for Associateship of the Indian Agricultural Research Institute, New Delhi.

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EMBRYOLOGY OF *EUGENIA JAMBOS* L.

L. VAN DER PIJL¹ published an account of *Eugenia jambos* in which he reported that the megaspore mother-cell directly gives rise to a 5-nucleate embryo-sac without the intervention of megaspores. The two chalazal nuclei of the 4-nucleate embryo-sac are said to function as polar nuclei and the egg and one synergid are said to be sister-cells formed by the division of the two micropylar nuclei. In his paper on polyembryony in *Eugenia*, Tiwary² did not trace the origin of adventive embryos in *E. jambos*.

During an embryological study of *E. jambos*, material of which was collected from Botanical Garden, Forest Research Institute, Dehra Dun, I made the following observations:

The youngest ovules sectioned showed a crassinucellate condition with a very deep-seated elongate megaspore mother-cell which undergoes the usual meiotic divisions to form

a linear tetrad (Figs. 1 and 2). The chalazal megaspore functions. The degenerating remnants of the remaining three megaspores can be differentiated quite easily from the degenerating nucellar cells surrounding the embryo-sac and I can state definitely that the megaspore mother-cell never functions directly as the megaspore as indicated by Pijl. Occasionally one of the dyad cells may show belated division (Fig. 3) and rarely a megaspore, other than the chalazal, may show some enlargement. Frequently the degenerating megaspores form a very long densely staining streak above the functioning megaspore (Fig. 4).

The embryo-sac passes rapidly through the 2-, 4- and 8-nucleate stages which are quite typical (Figs. 5, 6, 7 and 8). The synergids are very conspicuous vesicular structures (Fig. 9).

In exceptional cases at the 2-, 4- and 8-nucleate stages all the nuclei may be seen grouped together near the centre of the embryo-sac. Many embryo-sacs showed an irregular disposition of nuclei, whose number was variable, sometimes more and sometimes fewer than eight (Fig. 10). A fusion of adjacent embryo-sacs seems possible and might explain the larger number of nuclei. The smaller number may be caused either by an early degeneration of some of the nuclei or occasional abortive divisions.

In a few instances the narrow chalazal end of the embryo-sac was found to penetrate between the cells of the chalazal tissue, thus giving the appearance of a chalazal haustorium. In some other cases the mature embryo-sac was found to have digested its way through the nucellar tissue and come in contact with the cells of the integument (Fig. 11).

Pijl has reported a degeneration of one of the synergids on the entry of the pollen tube but my observations indicate that quite frequently both the synergids may remain intact even after fertilization (Fig. 12).

Although Pijl supports normal fertilization by various indirect methods he does not clearly mention the fate of the zygote. My observations show that the egg degenerates in most cases and this is followed by nucellar budding from different places around the embryo-sac (Fig. 13). In my preparations only one ovule showed a zygotic embryo with a very short suspensor (Fig. 14). In this case nucellar embryos were absent.

The adventive embryos are formed by irregular divisions of the nucellar cells which project into embryo-sac. A number of them of

various ages were found in healthy as well as in degenerating ovules (Fig. 15). If endosperm is not formed and the embryo-sac is obliterated they eventually degenerate but in healthy embryo-sacs their growth continues and more than one may reach maturity. Mature nucellar embryos usually show unequal cotyledons.

ment becomes highly differentiated consisting of small cells with dense cytoplasm. In several places this inner specially differentiated part of the integument may comprise more than one layer.

I wish to express my sincere thanks to Prof. P. Maheshwari for constant guidance and

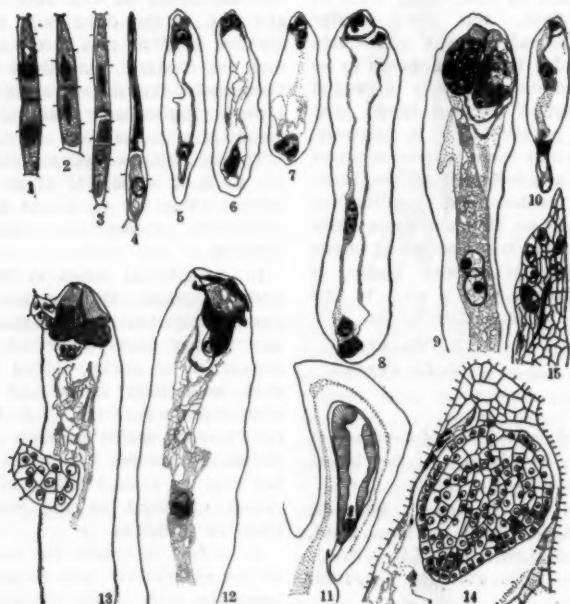


FIG. 1. End of meiosis I, $\times 94$. FIG. 2. Dyad cells in meiosis II, $\times 94$. FIG. 3. Belated division of upper dyad cell, $\times 94$. FIG. 4. Functioning megaspore, $\times 94$. FIG. 5. 2-Nucleate embryo sac, $\times 56$. FIG. 6. 4-Nucleate embryo sac, $\times 56$. FIG. 7. 8-Nucleate embryo-sac, $\times 56$. FIG. 8. Same, older stage, $\times 56$. FIG. 9. Part of mature embryo-sac showing prominent synergids, $\times 225$. FIG. 10. An embryo-sac, with the antipodals, polar nuclei and egg; the synergids are missing. The chalazal end is forming a sort of haustorium-like structure, $\times 56$. FIG. 11. Mature embryo-sac which has digested its way towards the chalaza, $\times 56$. FIG. 12. Embryo-sac after fertilization, $\times 56$. FIG. 13. Two nucellar embryos, $\times 56$. FIG. 14. Zygotic embryo, $\times 25$. FIG. 15. Micropylar portion of nucellus of a degenerating ovule showing adventive embryos; note obliterated embryo-sac, $\times 24$.

The endosperm is free nuclear. It is the micropylar end that attains the cellular condition first. However, the cells are poor in plasma and the whole endosperm is absorbed by the developing embryo. In older stages the nucellus also gets absorbed completely excepting a few cells at the micropylar region. Eventually these two are absorbed, so that the embryo-sac is surrounded directly by the massive integument. The innermost layer of the integu-

ment becomes highly differentiated consisting of small cells with dense cytoplasm. In several places this inner specially differentiated part of the integument may comprise more than one layer.

I wish to express my sincere thanks to Prof. P. Maheshwari for constant guidance and laboratory facilities and to Prof. Y. Bharadwaja for facilities and encouragement.

Dept. of Botany, S. K. Roy.
Banaras Hindu University,
Banaras-5, July 1, 1953.

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REVIEWS

Statistical Methods for Chemical Experimentation, Vol. I. By W. L. Gore. (Interscience Manuals), 1952. Pp. ix + 210. Price not given.

This book attempts to present chemists (and experimenters in other fields as well) with an account of the methods available for the statistical analysis of experimental data. The basic theory is completely excluded, only the final formulæ useful to the practical worker being given in the book. A number of tables required for the application of the formulæ are included at the end and the formulæ themselves are repeated in a collected form in Appendix B.

The treatment is 'straightforward' in that the reader is told what to do if a particular analysis is required. It has its own advantages and the book is well edited for this purpose; but the complete absence of the *raison d'être* of the various processes leaves one with a feeling of helplessness should a problem arise which is different from those treated in the book. The reviewer found the book not easy to read, both because of this difficulty of appreciating why a particular procedure is followed and also because of the involved style, as the following sentence chosen at random (p. 23) would show:

"It is by examining the properties of these derived distributions of statistics calculated from samples that it becomes possible to determine the reliability of statistical estimates."

However, the scope of the book is fairly wide, as would be clear from the following chapter headings: Statistical Concepts, The Reliability of Estimates, Analysis of Variance, Design of Experiments, Correlation and Regression, Attribute Statistics. It would therefore be a useful addition to technical libraries.

General Astronomy. By Sir Harold Spencer Jones. (Edward Arnold & Co., London), 1951. III Edition. Pp. 456. Price 30 sh. net.

The present edition which appears 17 years after the publication of the second edition retains the original plan of the previous editions, while the subject-matter has been completely revised and brought up-to-date. While not designed as a formal text-book for University Examinations, the first ten chapters will be very valuable, by way of reference, to students and teachers alike. In these chapters, problems

dealing with the motions of the earth, the sun, the moon and the planets are explained with lucidity and precision, and there is a chapter giving a description of modern astronomical instruments and their uses. The chapter on the sun gives a summary of the present knowledge regarding the physical condition of the sun and of allied topics like the solar spectrum, sun-spots, etc. Many, however, may not agree with the author when he advocates the reform of the calendar so as to consist of 4 equal quarters of 91 days (13 weeks) with one month of 31 days, followed by two months of 30 days each, with an undated *World's Day* in the middle of the year, and with an additional *Leap Day* at the end of the leap years.

Four chapters on the stars give a comprehensive and up-to-date account of our present knowledge about stars and measurements and laws relating to them, and the galactic and extra galactic systems. These chapters give practically all the general knowledge about stellar astronomy that the general mathematician or physicist, who is not going to be a specialist in astronomy, need know. The last chapter of the book mentions some of the current and unsolved problems of modern astronomy, and succinctly explains the present theories of cosmogony, including the origin of the spiral nebulae, star clusters, binary and multiple stars, and the solar system.

A mine of authoritative and up-to-date information is condensed into some 440 pages. The book will be widely welcomed by every one who is anxious to know the contents of general astronomy. C. N. S.

Institute of Physics Monographs for Students:

(1) *Fundamentals of Thermometry.* By J. A. Hall. (Pp. 48.) (2) *Practical Thermometry.* By J. A. Hall. (Pp. 51.) (3) *Soft Magnetic Materials Used in Industry.* By A. E. De Barr. (Pp. 62.) (4) *The Magnetic Circuit.* By A. E. De Barr. (Pp. 62.) (Published by the Institute of Physics, London), 1953. Price 5 sh. each.

This series of booklets is mainly intended for students studying for the Higher National Certificate in Applied Physics issued by the Institute of Physics. However, they are sure to be greatly appreciated by a much wider class of readers. The first two books on thermometry

deal with the principles of temperature measurements and the practical details concerning various types of instruments employed for this purpose. All the three types of thermometers, the platinum resistance, the thermocouple and the optical pyrometer, are considered in good detail. The emphasis is upon the International Temperature Scale, with defined fixed points, rather on the absolute thermodynamic scale. Many of the details given in these two books will be found useful by research workers in other branches of physics who find it necessary to measure temperatures with reasonable precision.

The two books on magnetism deal with the properties of ferromagnetic materials and how to make them into magnets for use in instruments. They contain a fine review of the various available data, and the presentation is greatly simplified by the inclusion of a large number of graphs and tables. While Booklet 3 deals with only soft magnetic materials such as the silicon-iron and nickel-iron alloys, Booklet 4 contains in addition to a description of the magnetic circuit and its applications, also a short account of permanent magnet materials, the ferrites and special materials such as Fe-Co alloys and Perminvar. It is unfortunate that the contents are far too biased towards industrial applications and that applications in pure research are completely omitted. For instance, there is no mention anywhere of the design of electromagnets to produce large magnetic fields, or the nature of the materials used in their construction. However, the two books will be much appreciated by electrical engineers and instrument technologists.

G. N. RAMACHANDRAN.

Field Experimentation with Fruit Trees and Other Perennial Plants. By S. C. Pearce. (Technical Communication No. 23 of the Commonwealth Bureau of Horticulture and Plantation Crops, East Malling, Maidstone, Kent, England.) Pp. 131. Price 10sh. or \$1.40.

This book is 'addressed to the practical experimenter and not to the mathematician, who will find little that is novel'. It contains some 'ideas' and new 'techniques' which the author developed as a member of the Statistics Section of East Malling applying statistical methods to problems of experimentation. The concepts and practice of design of experiments are developed with special reference to fruit and other perennial plants. Practical difficulties in field

experimentation are fully discussed and methods of solving them have been suggested. This special feature of this book is probably the result of author's experience in this field.

Starting from the simple randomised block design and Latin Square, more complicated designs, such as multiple Latin Squares, split-plots, criss-cross, stripe, tile and incomplete block designs have been introduced and the situations in which they are likely to be useful have been indicated. Further problems treated are the use of covariance analysis, determination of optimum size and shape of the plot from uniformity trial data, the importance and use of trial designs, transformation of the variables for analysis of variance, analysis of complex experiments conducted over several years and adjustments for missing plots.

The book ends with a series of appendices on (1) methods of analysing data for orthogonal designs; (2) partitioning of treatment sum of squares in an orthogonal design; (3) a general method of analysing designs; (4) analysis of covariance in an orthogonal design and a comprehensive list of references. The appendices are illustrative in character and are extremely useful in a book of this kind. On the whole, though limited in scope, the book covers a good ground and will be of use to the practical experimenter who has some knowledge of statistical methods and who can properly interpret tests of significance.

C. RADHAKRISHNA RAO.

Geometrical Optics. By C. Curry. (Edward Arnold & Sons), 1953. Pp. viii + 174. Price 21 sh.

The author claims in his preface that the book has been written "to give a more balanced account of the subject in which the underlying physical principles and the ultimate application to optical instruments and their design are always kept in view". A certain amount of success has been achieved in this direction, though one can normally expect a higher standard of performance. Suitable text-books on this subject are rather rare, and to that extent, Mr. Curry's book is certainly welcome.

The first few chapters form the basis for a proper understanding of the subject. The treatment conforms to the usual level and includes a good presentation of the Lagrange and Newton formulae, aplanatic points, the optical sine relation, the cardinal points of lens system, etc. A beginning has been made on the topic of trigonometrical ray-tracing, but has been termi-

hated rather abruptly asking the student to refer to Conrady's *Applied Optics and Optical Design*. It would have been a very welcome change, if the subject has been pursued further leading to the full data for the computation of a lens system like a simple achromat. A student of practical applied optics would then have found ample scope for a fuller appreciation of the usefulness of this aspect of the subject.

The most welcome feature of the book is the chapter on "Aberrations of Optical Systems". The treatment is simple and well-suited for a beginner and is a good presentation of a rather difficult topic. Nice illustrative figures are given wherever necessary. The book concludes with a chapter on the "Design of Optical Instruments". The author contents himself with giving a detailed description of the various optical components. Again, a student of practical applied optics would certainly miss some of the details that he wants, were he to launch upon a programme of designing and making a component himself.

The book is certainly to be welcomed for the very elegant treatment adopted.

S. HARIHARAN.

Volume and Integral. By W. W. Rogosinski.
(Oliver & Boyd, London), 1952. Pp. 156.
Price 10 sh. 6 d. net.

This book of 156 pages gives a clear account of the Lebesgue-Integral (absolute integral), and is intended for the Honours students. The book gives an excellent introduction to the subject by properly setting forth the background; those who consider that the Honours syllabus should certainly include the modern notion of the Integral—this modern notion is about 50 years old—will find in it a suitable text-book.

The needs of the students have been kept in mind by the author who has brought out the geometrical aspect of integration. The book is self-contained and has six chapters, mostly of about 25 pages each; the chapter on the Lebesgue-Integral contains 35 pages. The first chapter is on sets of points. The second chapter deals with the notion of content as defined by Peano and Jordan; at the end of the chapter it is pointed out that, despite its apparent efficiency and conformity to intuition, this definition of content leaves much to be desired from the purely mathematical point of view. The third chapter is on measure; its last two articles deal with non-measurable sets and Vitali's covering theorem. The fourth chapter gives an account of the Riemann-Integral, and the last

article in the chapter is about the deficiencies of this integral. The fifth chapter is on Lebesgue-Integral and the sixth is on integration and differentiation according to Lebesgue.

The book contains 35 exercises and their solutions have been indicated. The last theorem in the book bears the number 101. Besides these, there are full discussions of some examples, such as, for instance, Volterra's example of a function $f(x)$ whose derivative $f'(x)$ exists for all values of x , $f'(x) \leq 3$ and yet $f(x)$ is not Riemann-integrable. The book contains an index. T. V.

Fatigue of Metals. By R. Cazaud. Translated by A. J. Fenner. (Chapman & Hall, Ltd.), 1953. Pp. xiv + 334. Price 60 sh. net.

This book, written by a leading authority on the subject is a welcome publication. It has an unusually large coverage of the available literature and the author's own contributions to it. A very comprehensive bibliography adds to the value of the book.

In the first chapter, the author briefly outlines the work done since 1829. Chapter II deals with the fundamental characteristics of fatigue fractures, their development under different stress systems and then describes various methods for the detection of fatigue cracks. Chapter III deals with earlier theories of failure by fatigue and their inadequacy in the case of dynamic stresses and also the subsequent theories of secondary stresses, limiting strain energy, etc., but points out that they are not sufficient to explain the fatigue failures. The next chapter describes types of stress systems in fatigue testing and various testing machines, which are in common use on the continent and U.K. At times their description is sketchy, but this is obviously beyond the scope of this book.

Chapter V reviews published data regarding fatigue limits of important steels and other alloys. The next four chapters present the data comprehensively showing the influence of various factors such as internal stresses, notches, threads, size and shape of parts and their surface conditions, corrosion, type of joints, etc., on fatigue strength.

The last chapter deals with various methods of improving the fatigue strength of machine components in service, from a consideration of the preceding test results, viz., smooth surface finish, introduction of compressive stresses in the surfaces, nitriding, generous fillet radii, rounding the roots of threads, etc. The chapter also discusses methods of design and choice of

materials, and methods of evaluating stress and stress concentrations in machine parts.

One never feels, while reading the book, that it is a translation, and Mr. Fenner has done a splendid job. There are, however, a few printing errors.

R. C. DESHPANDE.

Pollen Morphology and Plant Taxonomy Angiosperms. By G. Erdtman. (Almqvist and Wiksell, Stockholm and Chronica Botanica, Waltham, Mass.). Pp. 539. 261 illus.

Palynology, the study of the pollen grains of flowers and the spores of ferns and other flowerless plants, has lately grown out to a separate branch of science with a large literature. The study of these small, mostly one-celled objects is of interest from many points of view, purely academic as well as practical. They vary extremely much in size and shape and particularly in the structure of the cell wall, which is composed of one of the most resistant substances produced in the plant kingdom. Each plant species has its own type of pollen. Mostly, the pollen grains of closely related plant species cannot be distinguished from each other, but in the case of genera, the difference is often very characteristic.

The study of the form and minute structure of the pollen grains is in itself of interest and throws light on some important questions of cell and cell-wall formation. Palynology has further connections with many other branches of science: Systematics, in so far as the form of the pollen grains is one of the characters which should be taken into consideration when the affinities of plant groups are discussed. Geology and palaeobotany, because pollen grains in peat, lake deposits and other sediments reveal what kind of vegetation there was in the vicinity when the sediment was laid down. The detailed and reliable knowledge we now have of the history of the vegetation, and particularly of the forests, of the Northern Hemisphere in the Quarternary period is based almost entirely on the pollen analysis combined with the study of the stratification of peat, lake deposits, and so on; this has also thrown light on changes in climate, on pre-historic chronology, on the history of early agriculture, etc. Further connections and applications of palynology lead to so widely separate fields as the study of allergic diseases (Hayfever) and the control of honey, to mention two extremes.

Our knowledge of pollen has increased enormously during the last decades. Dr. Erdtman

(Stockholm), the leading specialist in this field, has now given us the first comprehensive book on modern palynology, based on the extensive literature and on the results of his own investigations. The book contains chapters of a general character, concise description of methods, and definition of the overwhelming number of terms which palynologists, including the author, have found necessary for the description of the pollen grains. By far the largest part, however, consists of the description and discussion of the pollen morphology of the various families, which are arranged alphabetically. This part (pp. 28-458) contains a wealth of new observations. The book is abundantly illustrated with excellent drawings, the standard magnification being 1,000.

For all those who in any way have to deal with pollen (and their number is steadily increasing), this book is a most welcome one. It shows clearly the present status of our knowledge in this field, it opens new paths for studies, and it gives a solid basis for all our work on pollen.

OVE ARBO HOEG.

Books Received

Reactivity of Free Radicals. (Discussions of the Faraday Society, No. 14), 1953. Pp. 256. Price 35 sh.

National Register of Scientific and Technical Personnel in India, Vol. III, Part I. (Scientists and Technologists.) (Published by the Council of Scientific and Industrial Research, New Delhi.) Pp. 578. Price Rs. 12.

Tables of Chebyshev Polynomials S_n^ and C_n^* .* (U.S. Dept. of Commerce, National Bureau of Standards, Applied Mathematics Series, No. 9). Pp. xxix + 161. Price \$25.00.

The Proteins, Vol. I. (Chemistry, Biological Activity and Methods), Part A. Edited by Hans Newrath and Kenneth Bailey. (Academic Press), 1953. Pp. xi + 548. Price \$12.00.

Method for Determining the Resolving Power of Photographic Lenses. (U.S. Dept. of Commerce, National Bureau of Standards, No. 533.) Pp. iv + 27. Price 75 cents.

Advances in Enzymology. Edited by F. F. Nord. (Interscience Publishers), 1953. Pp. x + 470. Price \$9.25.

Bibliography on the Genetics of Drosophila. By Irwin H. Herskowitz. (Commonwealth Circulation Bureau of Animal Breeding and Genetics, Edinburgh.) Pp. xi + 212. Price 21 sh.

SCIENCE NOTES AND NEWS

Margosa Leaves to Prevent Sprouting of Tubers During Storage

Dr. S. L. Tandon, Department of Botany, University of Delhi, writes as follows:

Considerable losses usually occur during the storage of potatoes due to sprouting, the sprouted tubers being of no table or seed value. Our investigations show that dry margosa leaves along with sand can advantageously be used as storage medium for potatoes because of their pronounced inhibiting effect on the sprouting of tubers. Only about 2 per cent. sprouted even after 180 days' of storage.

X-Ray Image Amplifier for Medical Use

Radiologists and physicians have a new tool in the X-ray image amplifier—a device that will give them a 200 times brighter view of their patient's internal organs in living action. Basically, the amplifier consists of a high vacuum tube that electrostatically focusses and accelerates an electron stream. Increased brightness of the X-ray image has been attained by converting the X-ray energy into light with a fluorescent screen, and thence to electrons by means of an adjacent photoelectric surface. These electrons are accelerated by a high potential placed across the vacuum tube, giving a brightness gain of 10 or more. A further gain is attained by electrostatic focussing of the electron stream to reduce the image to approximately one-fifth its original size. The reduced image, made up of high speed electrons, impinges on a phosphor output layer that converts the electron stream back to a visible image, now brightened 200 times or more. As a final step, the intensified image is magnified by means of an optical system without loss of the increase in brightness.

Nuclear Physics in London University

The first laboratory at a British University for Engineering Under-Graduate Training and Research in the techniques of nuclear physics was opened recently at Queen Mary College, London University. The laboratory's equipment includes a 1,000,000 volt impulse generator, the type of machine used by Cockcroft and Walton in their pioneer experiments on the artificial transmutation of the atom, and a 1,000,000 volt Van der Graff generator which

was built in the Department of Electrical Engineering to the specifications of the Atomic Energy Research Establishment at Harwell.

Structure of Desoxyribonucleic Acid

Franklin, Gosling, Stokes and Wilson of King's College, London; Wilkins of Medical Research Council; and Crick and Watson of Cavendish Laboratory, Cambridge, have proposed a structure derived from X-ray data and from stereochemical consideration for desoxyribonucleic acid ("DNA"). It suggests a possible way in which "DNA" might duplicate itself. "DNA" is a very long thin molecule, which is believed to carry at least part of the genetic specificity of the chromosomes in living cells.

Italian Research in Indian Ocean

An Italian expedition of four has arrived in Dar es Salaam to seek new evidence of the theory that Africa was once joined to Asia by a southern continent stretching over what is now the north-west part of the Indian Ocean. They believe that Madagascar, the Comoros, the Seychelles, and the Laccadive Islands are the surviving links of the submerged continent. Around these islands the expedition will search for clues to the old continent, especially through a detailed study of fish.

Water Disinfection with Iodine

The advantages of iodine over chlorine for disinfection of potable water has been recently stressed. It is stated that 8 parts per million of elemental iodine completely destroy 30 cysts per litre in 10 mts. in most natural waters. The iodine is in form of tetraglycine hydroperiodide which in combination with a mild acidifying agent releases nascent iodine. The periodide and the acid are incorporated in a tablet with talc and each tablet contains 20 mg. of the periodide.

Bursaries for Scientists

The Royal Society and the Nuffield Foundation, in order to fill a need in Commonwealth scientific relations, have decided jointly to initiate a Commonwealth Bursaries Scheme. The object is to provide facilities for increasing the efficiency of investigators of proven worth by enabling them to pursue research, learn techniques or follow other forms of study in

places in the Commonwealth which are peculiarly favourable.

The scheme will be in operation for an experimental period of five years. It is proposed initially to consider applications at six-monthly intervals, beginning early in 1954. Application forms will be obtainable from the Assistant Secretary, The Royal Society, Burlington House, Piccadilly, W1, and must be submitted not later than March 15 and September 15 in each year.

Pest Control

Experiments in the control of blowflies in refuse tips which have been carried out during the past year by the Pest Infestation Research Board, DSIR, England, have shown that, although synthetic insecticides prevent blowflies from emerging, an instance has been discovered of the flies developing an immunity. This is now entailing a reversion to pyrethrum mixtures.

Rural Research Centres in India

The Council of Scientific and Industrial Research in India has approved a scheme to open a series of research stations to help villagers. The "Vigyan Mandals", as they will be called, will undertake research in soil analysis and water analysis, and will also report on minor diseases.

Three stations, in Madras, Bihar and United Provinces, will be opened experimentally. If results are promising, the scheme will be expanded.

Essay Contest

The Philosophy of Science Group of the British Society for the History of Science is offering a prize of £ 50 for the best essay of not more than 4,000 words on: "What is the logical and scientific status of the concept of the temporal origin and age of the Universe?" (for example, as used in recent cosmological work). The essay should clarify the logical, theoretical and observational aspects of the idea of assigning a quantitative age to the Universe. Essays in English, French or German (in type-script) must reach the Honorary Secretary, Philosophy of Science Group, University College, Gower Street, London, W.C.1, not later than December 1, 1953, must bear a pseudonym, and be accompanied by a closed envelope containing the pseudonym and the author's name. Essays submitted will be treated as material offered to the *British Journal for the Philosophy of Science*.

Prof. T. S. Mahabale

Prof. T. S. Mahabale, who is a Vice-President of the Section of Palaeobotany, has been invited to preside over a colloquium on "The Secondary and Tertiary Floras of the Southern Hemisphere: Their Origin, Composition and Migrations", during the ensuing International Botanical Congress to be held in Paris in July 1954.

Commonwealth Bureau of Pastures and Field Crops

The Bureau which has been attached to the Welsh Plant Breeding Station, Aberystwyth, for the past 24 years will be transferred to Hurley, Berkshire, in August 1953, where it will be attached to the new Grassland Research Station, of which Dr. Wm. Davies is Director.

This Bureau, one of the 10 Commonwealth Agricultural Bureaux, was founded at Aberystwyth in 1929, its first Consultant Director being Professor, now Sir George, Stapledon. For the first 20 years of its existence the Bureau was in charge of Dr. R. O. Whyte who was succeeded as Director in 1949 by Mr. A. G. G. Hill, formerly Director of the East African Agricultural Research Institute, Amani. The Bureau issues the well-known quarterly abstract journals *Horbage Abstracts* and *Field Crop Abstracts*, in addition to its other activities.

Technical Terms in Hindi

Provisional lists of technical terms in Hindi for Secondary Schools have been prepared under the auspices of the Central Ministry of Education for five subjects: Mathematics, Physics, Chemistry, Botany and Social Sciences. The lists now being released are tentative and will be finally approved only after public comments and suggestions have been received and considered. The terms in the lists seek to meet the demands of accuracy and intelligibility as far as possible, with greater emphasis on the former wherever there has been a conflict between the two objectives. Scientific terms, which are truly international, have, however, been retained.

ERRATA

Vol. 22, page 210: In the note on 'Paper Chromatographic Separation of B-Group Vitamins', read Univ. Biochemical Lab., for Univ. Bot. Lab.

Vol. 22, page 216, column 1, line 21: In the note on 'Occurrence of *Phoma chrysanthemicola* Hollos on *Chrysanthemum* Sp.', read 138-207 μ \times 110-138 μ for 138-207 μ to 110-138 μ .